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BURNETT, G. T.
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Jane Perry.
From her sister Charlotte
1840.

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BOTANOGRAPHIA;

OR,

SUBJECTIVE BOTANY, INDICATED IN OUTLINE.

PRINTED BY J. AND C. ADLARD,
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OUTLINES OF BOTANY,

INCLUDING

A GENERAL HISTORY OF THE VEGETABLE KINGDOM,

IN WHICH

PLANTS ARE ARRANGED ACCORDING TO THE SYSTEM OF NATURAL AFFINITIES.

BY

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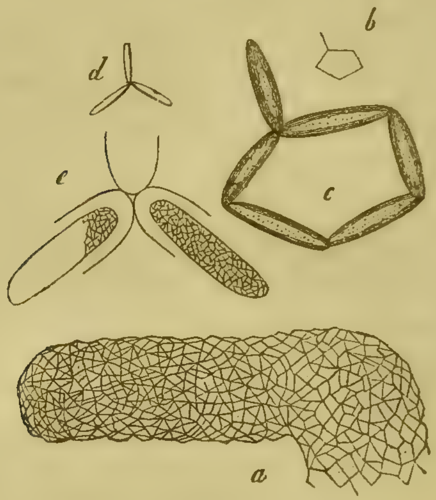
GEMINELLA INTERRUPTA.

(*a, b, c, d.*) The twin cellules.
(*e, f, g.*) The supposed tract of the invisible thallus. Vide § 139.

HYDRODICTYON *(pentagonum vel)* UTRICULATUM.



(*a*) A fragment greatly magnified, to shew its reticulated texture.
(*b*) A mesh, the natural size.
(*c*) Ditto slightly magnified.
(*d*) An angle, shewing the mode of connexion and points of separation.
(*e*) Ditto magnified. Vide § 188.

CORRIGENDA.

§ 383	*line* 12	*for* useless	*read* use*ful*
§ 533	— 25	— sapienta	— sapientia
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§ 4219	— 2	Transpose the words	*radius* and *disk*
§ 4452	— 3	*for ac*-cumbent	*read in*-cumbént
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Page 1091	— 70	— mon-	— di-œciorus
— 1093	— 40	— or	— stipules.

GENERAL OUTLINE

OF

SUBJECTIVE BOTANY.

ADVERTISEMENT.

THESE "Outlines of Botany" contain the heads of the Subjective Course of Lectures annually delivered by the author in King's College, London. Indeed, the first two chapters have been but little altered, since they were given as parts of an introductory address. For the views then detailed being still retained, no attempt has been made to repeat similar ideas in different words. This will explain, and may perhaps excuse, their didactic tone, as well as the half sententious style, that purposely prevails throughout the work.

Being intended as a practical guide, and chiefly designed for the use of students, the preceptive form has been adopted as the most simple and advantageous mode of communicating elementary knowledge; for controversial statements bewilder the beginner; and, as some points are unsettled in every science, it is the duty of a guide, when doubts arise, to indicate the course to be pursued; as the tyro is less likely to err when led by experienced authority, than when, distracted by debateable doctrines, he is abandoned to his own unaided discretion. This method, however, necessarily precludes an extended discussion of many curious and important problems, which, in an argumentative treatise, would deservedly occupy attention. But although here unnoticed, their authors must not consider that the works alluded to have been either over-

looked or underprized. From the perusal of all, much pleasure and information have been gained; and from most, some facts have been gathered, which hereafter may be, perhaps, made use of, even when the speculations they were intended to support, cannot be introduced. Though forced to be thus far exclusive, the author is most anxious to declare, that he does not at any time venture to advance his judgment as a criterion of the correctness of the doctrines he adopts, or of the unsoundness of those that he rejects. It was essential to his scheme that some selection should be made, and for the present one, which results from much patient consideration, he willingly holds himself responsible. Not, however, as being pledged to the defence, rather to the correction, of any known errors that may have been admitted, or any unknown, which the future advances of philosophy may shew; but as believing it to afford a fair, though brief conspectus of subjective botany, in its present state.

Such a summary, it is thought, cannot be otherwise than useful to students, for there are few questions they more frequently ask, than "what books shall we read? In what course shall they be studied?" and there are few to which it is more difficult to give a short and satisfactory answer. For science is so constantly progressive; and botany especially, of all the natural sciences, has lately advanced, and is still advancing, with such almost inconceivable rapidity, that there is no one work or series of works which can be referred to as containing a full or sufficient abstract of the present state of knowledge. But, in order to march at all in the van of science, references must be made to many volumes, and additions and corrections must be drawn from many collateral sources of information. From these it is the duty of the lecturer to cull, and it is this ready engrafting of discoveries, as they are made, which gives one of its chief advantages to oral over written instruction.

Therefore, at the conclusion of the last session, while engaged in the preparation of a Syllabus, it seemed to the author

that an opportunity had occurred of giving, in some sort, an answer to the questions above proposed, by referring, under the several successive heads of lectures, to the books or chapters in which the several respective subjects have been most satisfactorily treated.

But, besides their overwhelming number, many of the references being to monographs published only in the Philosophical Transactions of learned societies, or to essays scattered through various British and foreign scientific journals, some of which it would be difficult, and others impossible, for students to procure; and furthermore, much of the most valuable information being locked up in works too costly for general purchase, or too voluminous for general perusal, it soon became evident that such could not be the answer which it was fitting the student should receive.

Hence, in addition to the bare references to many ponderous tomes, occasional extracts both of figures and descriptive text were made, especially from the more rare and costly; but these, even when abridged, gave to the prodromus on which they were engrafted, the appearance rather of a manual than a prospectus.

Such were the chief steps which led to the compilation of this *vade mecum ;* for, having thus far advanced, the author was persuaded to give it a more comprehensive character; and, to make it not so much a text book to the college lectures, as an introduction for general use, to those more elaborate standard works which constitute the body of the science. For most of these, even if consulted in public libraries, instead of being studied, as they should be, in the closet, are suited rather for the perusal of the veteran, than the novice; while others, which, when advanced, he cannot be without, seem to require some such initiation as this, to enable the pupil to consult them with advantage.

This primer may therefore be considered as a humble introduction to such standard works as those of Greville, Turpin, Vaucher, Dillwyn, Turner, Fries, and Fee, from which the materials of the Outlines of Algologia have been chiefly drawn, as well as to those others to which references will successively be made in the Outlines of Fungologia, Muscologia, Filicologia, and the subsequent departments of the science.

Elementary works are of necessity compilations in many parts. It is their lowly yet useful office to glean on every side, and aided by all their fellow labourers in the fields of science, who fling the liberal handfuls from every shock, to form a common sheaf for the sustenance of those who are as yet too young to work, or too weak in knowledge to gather for themselves.

Brett, in his principles of astronomy, has placed this matter in a very proper light. He says, "the advanced state of a science is but the accumulation of the discoveries and inventions of many. To refer each of these to its author is the business of the history of science, but does not belong to a work which professes merely to give an account of the science as it is; all that is generally acknowledged must pass current from author to author." This quotation* has been already made by one who is scarcely known to the writer except by name; still, one whom as labouring in the same field, though in a different part, he fain would call his colleague and his friend.

Much, therefore, that is absolutely new, should not be expected, nay, should scarcely be desired in such first steps to science; for established principles are to be inculcated, and truth is proverbially old fashioned. The author does not, however, mean to imply that modern discoveries have been neglected in the compilation of these outlines; he has already

* See the Preface to "Lindley's Introduction to Botany."

mentioned their magnitude and importance. As far as time and opportunity have permitted, he has sedulously consulted the works not only of past but also of present writers, and gladly acknowledges that he is indebted to both for very much of whatever may be found of worth in the following pages.

It is usual in semi-compilations like the present, to deprecate the charge of plagiarism by making the preface a confessional, in which catalogues are introduced of the works that have been chiefly followed. Were, however, such a list to be given here, it would be found of a most inconvenient length. For fully agreeing with Sir John Herschel that "Science is the knowledge of many, orderly and methodically digested and arranged, so as to become attainable by one," it is needless for the author to avow that he has read as many books as he could get, and has adopted and gathered freely from every side. Still that, as far as possible, honour might be given where honour is due, he has often, to his own inconvenience, quoted the original writer's words; and when other figures could more readily have been had, has thought it better to give the original illustrations. And now that the fruits of these researches are orderly and methodically digested and arranged, he trusts that the knowledge of many will be found to constitute a science easily attainable by one.

He does not, however, wish to shield himself from responsibility by deferring wholly to the authority of others; though names as great might in almost every case be given, as those already cited, as furnishing the chief materials of the outlines of algology. He feels himself as much responsible for that which he adopts as for that which is absolutely his own. Neither does he wish it to be supposed that there is nothing original in this work. He believes it will be found to possess, at least as much, if not more novelty, both in matter and method than is usual in such philosophical primers. Indeed, if there be any one feature about which he entertains more anxiety than another, it is the reception that will be given to those

changes which he has found it impossible to avoid making, in order to reduce materials collected from so many such different sources to an agreement in a common view. Whatever objections may be raised against it on this account, he is, however, fully prepared to meet; yet it would be wrong to volunteer a defence, and premature to anticipate objections; especially as at a future time this subject will become, in its regular course, the theme of consideration; and still more so, as he feels convinced that in reality the changes have been too few, and that they might have been introduced less sparingly, with manifest advantage.

King's College, London;
15*th March*, 1833.

PREFACE.

NATURAL history and natural philosophy are essentially sciences of observation. Facts are the only legitimate materials of such knowledge, the only bases upon which physical theories should stand. Analogy may be allowed to indicate, and speculation sometimes to suggest; but experience alone can be suffered to confirm those laws which induction may enact. When observations were few, the separate remembrance of the truths discovered was to most an easy task, and the unassisted powers of the human mind were sufficient to know all that then by man was known. But, as continued observations accumulated facts to an extent far beyond the compass of a finite comprehension, truths once known must have been neglected or forgotten, whilst others were learned, had not some schemes been devised for retaining possession of previous discoveries, and at the same time extending the bounds of human knowledge. Such schemes have been denominated *systems;* and scattered truths reduced to system constitute the rudiments of philosophy.

The distinction between a science and the things it treats of, though of primary importance, is too often overlooked; and the means mistaken for the end to be attained;—a fatal error, and one that leads to many misconceptions. For the latter are immutable, the former always changing; that is but the instrument of knowledge, these the matters to be known.

supersede are injudiciously depreciated, merely because they are inapplicable to the performance of duties that are not only incompatible, but for which they never were designed. Still, though systems, or methods of study, should be regarded as subservient, not paramount considerations, the improvement of such schemes should be no less zealously pursued than the knowledge of the subjects which are by them to be studied, for both are intimately connected, and reciprocally influence each other.

With such persuasions, and on such principles, the present work has been composed; and differing as it does in its manner, though not essentially in its matter, from the ordinary schemes of introduction, it seemed to require thus far an apology and explanation.

The difference adverted to chiefly consists in giving the *subjective* precedence of the *objective* view; and, considering subjective botany in general to be distributable, like other branhces of natural history, into several subordinate sciences, each devoted to the especial study of one great natural group of plants; the structure, functions, and uses of which will collectively form a complete, though subordinate science, as well as, disjunctively, constitute the several parts of general vegetable physics, of systematic and economic botany.

Besides several minor collateral advantages, which, as they will become evident hereafter, need not be dwelt on now, there are two or three chief ones, the mention of which can scarcely be omitted, as they are more essentially characteristic of the scheme. The first of these springs immediately from the distribution, just referred to, of general botany into several subordinate sciences. For, by this means the organs belonging to the plants in every class are discussed in turn without being confounded with those that are peculiar to each or any of the others. The arithmetician will at once perceive how much mental fatigue will be thus avoided: for he well knows the number of parts continuing the same, how very much their permutations are lessened by forming them into groups, between which no interchange takes place; instead of suffering the whole series to be uselessly permuted.

As the first advantage admits an arithmetical illustration, perhaps a geometrical analogy may be allowed to indicate the bearings of the second. For, as the mathematician finds the benefit great of commencing with obvious and established truths, as thus, when they at length arrive, he can solve with ease problems the most recondite and abstruse; so likewise the botanist gains an equal advantage by following the ascending synthesis, which, in the same manner, proceeds from known propositions to those which are unknown. Such a demonstration begins with the simplest plants; with those which have the fewest and simplest parts; with vegetables consisting sometimes of only a single organ; and thence gradually proceeds to develope their combinations in the more complex structures, as each additional organ is added or evolved: until at length the most elaborate organisms, which, considered by themselves, would seem intricate and obscure, are rendered clear and intelligible, from many of their intimate component parts having been previously examined in detail, and in their distinct and independent states.

The third and last advantage, of which notice shall be taken now, is closely connected with, and may be regarded as in some measure the offspring of, the former two. It is the much more copious history which is necessarily introduced of all the classes, and especially of those which include the simpler plants, plants which in general are too cursorily passed over. Those persons who maintain, the plausible paradox, that already too much is attempted to be taught in elementary works, may not be inclined to regard this increase as an advantage. The author, however, holds a contrary opinion; he believes that, instead of too much being attempted, such works more frequently attempt to teach too little. The burden complained of as great and grievous, he believes to be made intolerable only from injudicious accumulation. If the whole armoury of science instead of being distributed for use throughout the ranks, be cast into a common heap, then its weight indeed may crush a stronger than Tarpeian frame. Still, such a fatal reward can be easily avoided, by letting the instruments and materials of each be kept separate and dis-

tinct from those of the other departments. And if principles, as soon as they are obtained, be applied to practice, not only does the burden never become oppressive, but, from the interest thus early given to the subject, much more can be easily and with pleasure borne.

Should, however, the above not be considered a sufficient or satisfactory defence of the occasional deviation from the current doctrines of the day, as well as the conjunction of many common names, with more scientific and imposing terms, let it in the first place be remembered that the philosophic nomenclatures and arrangements of the present time are so numerous and so various, that it is impossible to reconcile or follow all; and therefore, instead of strictly adhering to any one, it has been thought preferable to attempt to bring together the most valuable features of the whole. And, in the second place, it should not be forgotten that utility alone has been the ruling object of this guide; its highest aim, the humble hope of familiarizing science, and facilitating the acquisition of truths, the only legitimate materials of philosophy. Let these be, therefore, firmly held; and, when once surely made his own, the student may be as regardless as he pleases of the storehouse in which they have been found, and the machinery by which they have been purveyed.

Hence, in conclusion, the author would remind the reader that, the systematic cords by which facts are here, as it were, bound together into bundles, and the speculative vehicles in which they are conveyed to the student's mind, as materials to the workman's or the builder's hand, are never to be regarded as more than implements, often necessary, always convenient, for the advantageous application of the mental powers, and must not be mistaken for the work they are destined to perform: therefore, when the building is complete, the cords, the scaffolding, and the various tools, by which it has been raised, may, at the pleasure of its owner, be removed.

85, *Norton Street, Portland Place.*

SUBJECTIVE BOTANY,

INDICATED IN OUTLINE.

INTRODUCTION.

(1.) BOTANY, superseding the ancient *Herbcraft*, is the name now given to the science which relates to all those inferior ranks of the organic creation called PLANTS, or *vegetables*.

(2.) But what is a *plant?* What do we mean by this word *vegetable?* It is a term the most ignorant presume they understand, although the most learned are unable exactly to define; for a plant is, indeed, as Theophrastus long ago observed, "a various thing, of which it is difficult to give a definition."

(3.) Tell a clown it is difficult to distinguish an animal from a plant, he will smile incredulously, and perhaps will say, "Can I mistake *man-orchis* flowers for men?" but show him a

(*a*) Ophrys apifera, the Bee orchis. (*b*) Ditto, tuberous root. (*c*) Flower separate, to show the insect form.

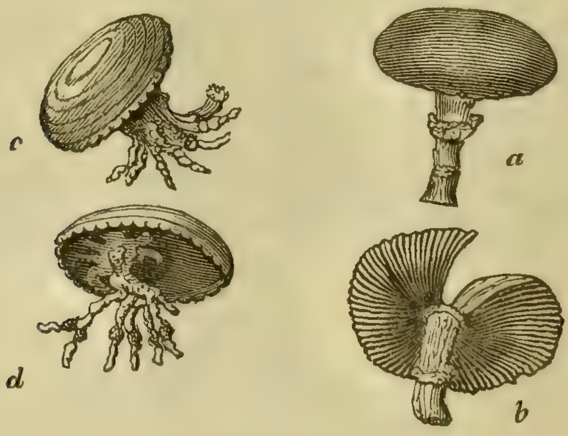
(*d*) Ophrys muscifera, or Fly ophrys. (*e*) Tuberous root. (*f*) Flower separate.

(*g*) Aceras anthropophora, the green Man-orchis. (*h*) Root of the same. (*i*) (*i*) (*k*) Flowers separate, to exhibit their anthropomorphous appearance, as figured by Rudbeck.

conferva and a *polype*, a *lichen* and a *coralline*, a *flustra* and a

(*a*) Ceramium ciliatum, one of the confervæ. (1 *a*) A portion magnified. (2 *a*) A portion with fruit, still further magnified.

(*b*) Hydra fusca, one of the polypes, greatly magnified. (1 *b*) The same, in its contracted state.



(*a, b*) Agaricus campestris, common field mushroom.

(*c, d*) Medusa pulmo, a molluscous or acalephous animal.

flag, or even a *mushroom* and a *medusa*, and he will at once confess, at least by silence, if not by words, that he "kens not which they be."

(4) Such presuming self-confidence in what they know, is "the badge of ignorance and the curse of fools:" it is the humble privilege of the wise alone to doubt; and they who know the most are always the most sensible how little the most enlightened know.

(5) But this matter is apocryphal, not to the unlearned and the ignorant alone: physiologists the most astute have laboured, and do labour still, in vain, succinctly yet comprehensively to define a plant. The difficulty, however, lies not so much in the perception of the differences which undoubtedly do exist, as in reducing these perceptions to the progressive scale of a still very imperfect language. The dilemma somewhat resembles that in which an ancient philosopher is said to have been involved; who, when desired to state what motion is, after much consideration, rose from his seat, walked towards the inquirer, and replied "You see it; I can show it to you; but I cannot tell you what motion is." Thus also, to the opening question, a botanist might answer, "Here are plants; you see them; I can show them to you, even if I cannot precisely tell you what a vegetable is."

Aspidium Baromez.

This fern is commonly known as the Tartarian lamb. One of the best specimens the author has seen is in the possession of the Medico-Botanical Society of London, and of its general appearance the above figure gives a very good idea. It contrasts well with the following arboreous fern, the Cyathea glauca; showing, as they strongly do, the great variations in external form that prevail among plants which are naturally arranged in the same section, class, and order.—See also numerous other illustrations in the figures given in the subsequent pages.

Cyathea glauca, an arboreous fern.

(6.) Let not the bearing of this statement, however, by any one, be misunderstood! Remember, it is not science which *makes* the difficulty she here points out: she only shews what already is; just as a microscope does not *make* the hairs on a mite's back, but only brings them within our sphere of vision.

(7.) Examine for a moment some few specimens illustrative of the different departments of the vegetable world; such as mushrooms [vide § 57], flags [vide § 41, 47, 51], and mosses [vide § 59]; jointless and jointed ferns [vide § 64]; grasses [vide § 72], sedges, rushes, lilies [vide § 75]; palms [vide § 81], pines [vide § 85], cycases [vide § 85], and forest trees [vide § 97, 100], or other more showy herbs, and shrubs, and selworts [vide § 111]; of each of which extensive sections, examples, however copious, must of necessity be comparatively meagre, and yet which are scattered in such infinite profusion "o'er all the deep green earth," that their varied forms and beautiful appearances are familiar to the least observant. Let the inquirer examine these, and say whether they do not confirm the dogma of him of old, that a vegetable is a various, a very various thing, of which it is difficult to give a definition; and whether they do not equally proclaim that science does not make the difficulty she here points out; whether they do not declare that she only shows what already is, although it may have hitherto escaped our observation.

The perception of difficulties does not increase, neither does ignorance thereof lessen their extent. The unlearned do not know more truly because they are insensible of the imperfections of their knowledge, any more than a road becomes smooth to the purblind, merely because they do not see its roughness. What-

ever is, still is, whether men know it or know it not. Doubtless, from the beginning eight planets always were, although the ancients knew but seven; for Herschel's telescope did not create the Georgium Sidus, but only showed to man what mortal eyes had never seen before.

(8.) But the difficulty of diagnosis between animals and plants, and even between living and lifeless beings, so often and by so many dwelt on, is rather a speculative than a practical obscurity. Every one is sensible of differences existing between the numerous productions of nature; for, were not such differences obvious, the whole would be esteemed not various, but the same. All persons, then, distinguish the peculiarities that mark the successive grades of physical existence, though few are competent to state precisely in what that difference consists. The one is the unsought observation of the savage, the other the hard-earned achievement of the sage; the former a perception that no one can avoid, the latter a science in which, not seldom, the wisest are at fault.

(9.) Now this great and extraordinary variety, this almost infinite diversity, in the structure and functions, the characters and appearances, the properties and purposes of plants, which renders it so difficult to frame a concise definition, rigidly including the whole, and as strictly excluding all that WE *think* not plants, which circumstance so many have bewailed, and which some superficial philosophers have regarded as the reproach of botany, because it suits not their weak and artificial systems of arrangement, so far from being an "*opprobrium botanicum*," is, in truth, one of the chief advantages of which the science has to boast; so that, if we wished for a change at all, we should wish, although it is needless, that the variety were ten times greater.

(10.) Because, although the vegetable kingdom, by stretching to such wide extremes, may render the absolute definition of a plant somewhat abstruse and difficult; and although in some cases, at the confines of the animal and vegetable reigns, doubts may arise as to whether certain microscopic beings are animals or plants; belong to this kingdom or to that, or, in fact, to either, still their ambiguity, which has been lamented as an extreme disadvantage, when rightly viewed, becomes a guide, as it at once affords an index to elucidate the things themselves; for their very obscurity indicates their station, by referring them to the debateable land of natural existence. And, furthermore, it of course will follow that

the greater the differences existing among decided plants, the stronger will the contrasts be, and, of course, the more readily will they be distinguished from each other: a secondary advantage, which, in practice, far outweighs any slight inconvenience attending the diffuseness of the primary definition.

(11.) Still when, as botanists, we presume to talk of plants, it may fairly be required that we should attempt to solve the question that so continually recurs: viz. what is a vegetable? For plants are the principles upon which all botanic lore depends; they are the very subject matter upon which we must discourse: and as, although we cannot absolutely, we can relatively define them, this relative definition should be given; and the more so as it will, in truth, be found to be all that can legitimately be sought, in any department of natural philosophy.

(12.) With this relative definition we shall therefore rest content; for the search after the abstract and the absolute too often becomes, as Butler well observed, on a somewhat similar occasion,

> "An ignis fatuus that bewitches,
> And leads men into pools and ditches."

(13.) To show what constitutes this various thing we call a vegetable; i. e. to indicate the various phenomena exhibited by certain physical existences, to note what characters distinguish the organic from the inorganic world, and amongst organic beings the vegetable, or merely vital, from the animal or sensual creation; in a word, which constitute the several grades of men, of brutes, and of plants, is doubtless a worthy task; and, as the pursuit involves much useful and important knowledge, it must form a part of every enlightened botanist's researches. It is the time, and mode of investigation, that admit dispute; not the necessity of the research itself.

(14.) Plants are very numerous, and often very various; but the relative similitudes and comparative differences by which they are associated and distributed into more or less comprehensive groups, and allied to or distinguished from each other, as well as to and from the contingent animal and mineral kingdoms, even when great, can be duly appreciated, and when slight, can often be perceived, only by those who are conversant with their positive characteristics; i. e. are practically familiar with the subjects to be distinguished and defined. Hence, as plants are the subjects

of inquiry, a practical demonstration of their positive individual characters would seem rightly to precede a collective theoretical definition of the vegetable reign, and its comparative demarcation and extent; and such is the plan we here design, in the first place, to follow.

(15.) For the present, therefore, we shall let the more speculative problem pass; to it, however, we shall return hereafter: and its consideration is only now delayed, that a previous practical demonstration of plants, as they are found in nature, may the better enable us to venture on its solution. Hence, to a not distant future we postpone the definition of a plant, and now propose, as a more useful preliminary step, to practically show what a varied thing a vegetable is.

(16.) Plants are the subjects of botany; their attributes the objects of the science: hence, two schemes of study, the subjective and the objective, lie before us; each of which may be pursued in opposite courses; i. e. either by analysis or synthesis, whence the anterior and posterior arguments result; between these the selection must be made. The former descends from generals to particulars, the latter ascends from effects to causes; that being essentially more abstract, this more practical, in its course. Each has advantages peculiarly its own; hence, both should in turn be studied, and neither exclusively neglected or pursued. But, as the anterior argument requires much antecedent knowledge, while the posterior can trace back from none, that being the fruits of learning, while this is the means to learn; although the first is the most comprehensive, the last is the most familiar, and hence it is that with which we shall commence our labours.

(17.) Although differing essentially from the usual schemes of investigation, synthesis shall here precede analysis, and the subjective now be made the forerunner of the objective view; for it seems advisable, at least occasionally, to commence with a practical demonstration of plants as they are found to exist in nature; and to show their positive characters before comparisons are instituted between them and the other kingdoms of the organic and inorganic worlds: in fact, *first* to have materials to compare before comparative views are taken. Hence, after giving a general conspective glance at the whole, it is proposed to demonstrate the

special structures, functions, properties, and uses of each succeeding group of plants, from the lowest to the highest grades; and this before any general views or comparisons are instituted, even between the varied developments of equivalent organs, as pervading the whole vegetable kingdom, and much before any are made between the different, and often essentially diverse, constitutions of the adjacent animal and inorganic reigns.

(18.) It is evident that the subjective synthesis will demand much less previous knowledge, and require much less to be assumed, than any other mode of investigation. Still, even here, something must be accorded: we must grant what, however, few would venture to deny, for it is a postulate without which no step can be advanced; viz. that the examples adduced, and to which reference has been made, as the flags, funguses, and mosses, ferns, grasses, and so forth, are truly vegetables. These groups have been selected merely to illustrate the varied characters of plants: that they are really such, must be *proved* hereafter; that they are what they are described, must be *granted* now.

(19.) Something must be assumed in every science; and, to profit by the experience, the pupil must be content to take something at first on the authority of the teacher; seldom, however, more than admits of no dispute. For, although it is convenient, in order that every point, even the simplest, may receive its due share of consideration, to assume, and, as far as possible, to act on the assumption, that all students are totally ignorant of the subjects to be discussed, yet it is notorious that such *tabulæ rasæ* are never met with: many things are unavoidably known to almost all; our very existence convinces us of many: such, therefore, as such alone should be, are the postulates assumed; and, from the certainty of things already known, we either proceed to inform ourselves respecting those which are as yet unknown; or not only this, but, from knowledge thus acquired, we are enabled to correct those errors by which, either from ignorance or prejudice, we had been previously enthralled.

(20.) The following simple enunciation of some of the chief results of the analytic scheme, viz. the segregation of acknowledged plants to constitute the vegetable kingdom, and the subordinate distribution of this kingdom into secondary and tertiary groups, or classes, if used, as here proposed, merely as a guide,

may also with advantage precede the development of the synthetic associations, although the detail of the analysis be deferred, and the results, as it were, almost empirically assumed.

(21.) In the following practical solution of the problem, "what is a vegetable?" examples will, therefore, at once be drawn from each of the most commonly acknowledged and the most strongly marked regions and classes, and from several of the subordinate departments of the vegetable reign. Most of these groups have been long established and generally received; and, although their names may at first have been waywardly imposed, custom has now rendered them more or less current terms; and science, if she has scrupled to adopt the popular language, has not scrupled to avail herself of popular observations, and has frequently followed and confirmed the popular distribution—as a reference to these and future tables and diagrams will show: and as, with very slight modifications, many of our common and familiar words may be rendered synonymes of less familiar technicalities, they will now be used in preference; not, however, as superseding the terms of science, but as paving the way for their introduction.

Plants or Vegetables.	Musts or Worts	Flags or	Algæ	ACOTYLEDONES	Plantæ vel Vegetabilia.
		Mushrooms or	Fungi	Mycaffines	
		Mosses or	Musci	CELLULOSÆ	
	Leas or Herbs	Ferns or	Filices	MONOCOTYLEDONES	
		Grasses and Sedges, or	Gramina	Termaffines	
		Palms, Lilies, &c. or	Palmares[a]	ENDOGENÆ	
	Cresses or Plants	Pines and Zamias, or	Zapini[b]	DICOTYLEDONES	
		Cresses, Fruges, vel	Eucarpæ[c]	Crescaffines	
		Selworts or	Selanthi[d]	EXOGENÆ	

(22.) It is curious to observe, notwithstanding their characteristic peculiarities, the general coincidence that subsists between the popular and scientific distribution and nomenclature; for the Algæ, Fungi, Musci, Filices, Gramina vel Segetes, &c., are but technical synonymes for nearly equivalent classes of plants, known to all as Flags, Mushrooms, Mosses, Ferns, Grasses, Sedges, and so forth: and this is still further remarkably the case in the

[a] Including the Petaloid Endorhizæ of Richard, or Monocotyledons of Jussieu.
[b] Including the Synorhizæ of Richard.
[c] Including the Exorhizæ of Richard.
[d] Including the Cytineæ and Rhizantheæ of authors.

Primary Groups admitted by Linnæus.

Vegetabilia	Monocotyledones vel Fruges	Palmæ or	Palms	(Principes)
		Gramina or	Grasses	(Plebeii)
		Lilia or	Lilies	(Patritii)
	Dicotyledones vel Plantæ	Herbæ or	Herbs	(Nobiles)
		Arbores or	Trees	(Proceres)
	Acotyledones vel Cryptogama	Filices or	Ferns	(Novaccolæ)
		Musci or	Mosses	(Servi)
		Algæ or	Flags	(Vernaculi)
		Fungi or	Mushrooms	(Nomades)

(23.) We attempt not here to justify the classes and the regions into which the vegetable reign, or kingdom, has been almost universally distributed: this will engage our subsequent attention. Neither are we called on to defend the names which custom has in general too loosely applied thereto, and which science very often too fastidiously condemns. Much of the arrangement seems very natural, and most of the terms, if used with somewhat more precision, highly expressive: and why should not English names be as carefully defined as Greek and Latin words? for, although not all so classically elegant as some of our botanical nomenclature is, they are equally intelligible, and far more euphonious, than many semi-barbarous technicalities; but of this, more hereafter: neither their correctness nor their elegance concern us now; sufficient is it for the present purpose that they are generally known, as we merely propose to use the vulgar terms, because, although many persons are well versed in botanical language, to some it may not be familiar. That our veterans will be pleased to excuse this innovation, there is no doubt; for they are ever the last to condemn the adoption of any method which may tend to familiarize science, and facilitate the progress of the student. Who is there that has not at some time felt the galling yoke of technicalities? Who is there that has not found that, to learn a science, and at the same time to be obliged to learn a language, is indeed to have the tale of bricks demanded, while the straw to make them is denied. We shall, therefore, in order to lessen or avoid this evil, in conjunction with the scientific names, employ the common English synonymes, whenever such exist; and, when there are not any known, translate the stranger epithets into our mother tongue.

(24.) To this scheme no valid objection can be made; for, if of temporary service only, and at once discarded when its first ob-

jects have been attained, it must still, by lessening the difficulty of acquiring a sometimes abstruse terminology, eminently subserve the purposes of the general conspectus, of those several most important and commonly accepted regions of the vegetable world, which is to precede the subjective outline of each included section.

GENERAL OUTLINE.

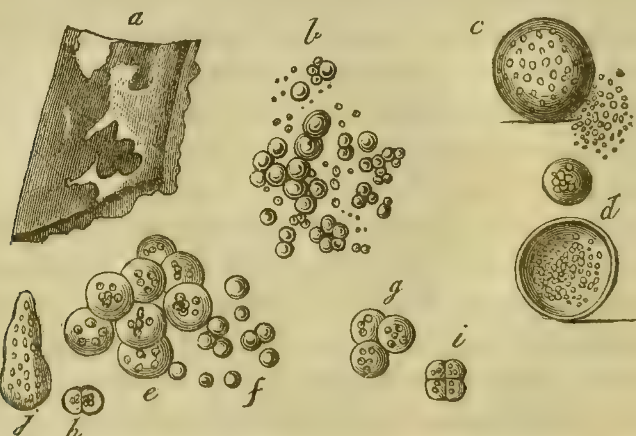
(25.) In the ocean, in rivers, and especially in stagnant water, as well as in many damp situations on shore, myriads of minute animals and plants exist, which for ages were utterly unknown; or, if noticed, were mistaken for the foam of the waves, or the exuviæ of the bodies amongst which they abound.

(26.) So minute are some of these infinitesimals of vitality, that, in a drop of water, it is said there might be suspended five millions; and eight hundred millions, that is, almost as many as the entire human population of this globe, might, if collected, be contained in the space of one cubic inch.

(27.) Yet, small as are these *monads*, their structure is by no means so simple as is their bulk reduced; for Ehrenberg describes those species which, from their ultimate atomic minuteness, and resemblance to fine dust, have been called *termo*, *atomus*, and *pulvisculus*, to possess each from four to six, and in the atom many stomachs; and, furthermore, in the allied genera,* he has counted no fewer than from one to two hundred stomachs: i. e. from one to two hundred internal sacs, or digesting pouches, into which coloured fluids have been seen to pass; and in many others, these organs are equally elaborate, and the collateral structures curious in the extreme.

* *Cyclocœla, Orthocœla, Campylocœla,* and *Paramœcium.* From Ehrenberg's monograph on Infusorial animalculæ.

(28.) The most minute vegetables, however, which have been as yet discovered, are much less complex in their structure than animalculæ are found by zoologists to be; for these, in the lowest grades that have been accurately examined, appear to consist of simple cells, or threads, [vid. § 41, 47, 121, &c.] either free or springing from a slimy film, and which, although frequently associated, and often in contiguity, appear, in many cases, to have no necessary connexion with each other.



(*a*) Masses of Globulina botryoides, (Turpin.)
(*b*) Groups of plants removed and magnified: globules, some free and some uniting.
(*c*) A single parent cell, in which many smaller cellules are contained, and from which some have escaped. Also a young cell, in which they are just beginning to appear.
(*d*) Section of such a cell, to show the parental attachment of the young.
(*e, f*) Groups of cells and cellules, more or less connected or distinct: the younger opaque, and becoming transparent by extension.
(*g, h, i*) Cells united, and the form more or less changed by their union and compression.
(*j*) A distorted cell, probably formed of several united, their intervening coats becoming obliterated.

(29.) Allied to these simplest plants and animalculæ are certain ambiguous beings, which, on the verge of both kingdoms, seem to belong indisputably to neither: for in them some of the most distinctive characteristic signs of animals and vegetables are so conjoined, that at times they would appear to be both, and again indifferently either. Thus, their germs take root and grow like ordinary plants, while the fruit they bear seems to be possessed of voluntary motion, and to pass, in its development, through a stage of animal existence, before it, in its turn, takes root, and bears another generation. *Zoocarpes*, or *fruit animalculæ*, are the names which, not improperly, have been given to these connecting links of the animal and vegetable reigns.

(30.) Through these neutral tracts, which, while they bound, connect both kingdoms, the oft-disputed line of demarcation runs. From such obscure and debateable beginnings, plants and animals, as the dominion of each is on either side confirmed, gradually become less questionable in their forms, and assume their more essentially diverse structures. At this utmost verge of the vegetable domain, the present demonstration shall commence.

FLAGS, OR ALGÆ.

(31.) Several large and very curious groups of plants, which are allied to the Zoocarpes, but distinctly vegetables, have been collectively denominated Flags, or Algæ. Their English name has reference to the flagging habits of a large proportion; as, for example, the sea-weeds, which are usually fixed to rocks or stones, and flag, i. e. droop or float, according as the water quits them or bears them up. *Alga*, the technical synonyme, is said to be derived *ab algore*, coldness; as if the nominator had supposed that some of these productions, which are chiefly aquatic, were formed by the congelation of films or drops of water; to which, indeed, many bear no slight resemblance. To this ancient hypothesis there seems to be allusion in the names of several: e. g. *Ulva* (ab uligine,) signifies ooziness or moisture, as our English word *Laver*, from *laver* (à lavo), to wash, literally means *froth, scum,* or *lather;* whence, perhaps, lāver or lăver. Again, *Halymenia*, if literally translated, gives a pellicle of sea-water or sea-

membrane. Thus, also, *Achnanthes* is sea-froth; *Anthachne,* froth-flower; and *Alcyonidium,* the foam of the sea.

(32.) Many other similar examples might be given, for they continually occur, and in every language; although, when veiled in foreign tongues, or even when custom has given them an adventitious meaning, their original significations are not attended to. Thus, our own *mildew* is but a contraction of *soft* or *mild dew,* referring to the delicate texture of the minute plants of which mildew consists, and of which each spot is as it were a forest.

(33.) In the infancy of philosophy, such fanciful speculations and ideas, which we now think absurd, were common to all branches of science, and to other departments of natural history, as well as to the study of plants. Indeed, it is comparatively not long since an elaborate and learned disquisition was written, in order seriously to prove that the "flowing gossamer," the aerial spider's web, so common in autumnal mornings, is *not* scorched or frozen dew. The names alone are now happily all that remain to us of many of these crude doctrines, which we are too apt to denominate absurdities; not remembering that many of our received hypotheses, it is more than probable, are equally destitute of truth. They are but the clouds which attend the morning twilight of philosophy, and, as the sun of science rises, like the early dew, they pass away.

(34.) This class includes, in its several orders, sections, types, and genera, some of the most curious living structures which as yet are known. Protophytes, just emerging from lifelessness to life, and beings which, almost animals, still linger on the confines of the vegetable world.

(35.) Many of these microscopic creatures are so simple in their nature that their very simplicity renders them a doubt. Here, indeed, is the problem of which mention has been already made; for, so similar are many of the tribes of *algæ* and of *fungi,* that it is not only sometimes indeterminable to which of these two great classes certain individuals should be referred, but whether, in truth, they are plants at all; for, strange as the statement does appear, many of them may be parts of other organic beings; and to some there has been attributed an half-animal existence.

(36.) Upon this point, however, modern research has thrown very considerable and very important light; and several of those ambiguous things called infusorial animalculæ, and named and

arranged as such in their systems by zoologists, and to which, by some, an equivocal or fortuitous generation had been most gratuitously attributed, it is more than probable are not of an animal but of a vegetable nature: and, besides this, very many of the moving corpuscules, which have often been mistaken for monads, and which hence were once most unphilosophically supposed to have sprung into existence without parental aid, are proved to be merely portions of dissolved or dissolving organic matter, loosened in its structure, and put into motion by physical powers, which had previously escaped detection by the observant eye of man. Allusion here, of course, is made to the curious phenomena described by Porrett under the name of *Electrofiltration*, and which Dutrochet has termed *Endosmose* and *Exosmose*, i. e. a *flux-inwards* and a *flux-outwards*, from the circumstance of two currents of different strengths being noticed to pass through organic membranes, when the fluids on either side are of different densities or in different electro-chemical states; and which will either fill or empty a fixed saccule, or put a moveable one in motion. This fact was first observed, by Dutrochet, to take place in the cellules of a small conferva, or moss-like production, which he detached from a fish's tail; and hence it comes properly to be considered here. Each portion of this moss (?) consisted of a filament and saccule, from which globules were expelled, and into and out of which the currents of fluids passed. He produced other similar globules, by putting pieces of flesh into the water, so that their formation was not connected with the living state of the fish. He saw these globules spread throughout the fluid, agitate themselves in divers directions for an instant, and then precipitate themselves to the bottom of the vessel.

(37.) But methinks I see some ultra-utilitarian smiling at the thought of a grave philosopher being thus engaged, for hours, in watching the motions of a corpuscule so minute as to be scarcely visible to the naked eye; and methinks I hear him ask "cui bono?" a question which any child may ask, but one that the wisest philosophers must often find it difficult to answer, although they may be far from admitting the pertinency of the interrogation. When such queries are proposed, as they often are, I love to meet them with Franklin's counter-question, "What's the use of a baby?" for no one will venture to inquire what is the use of a man.

The experiments which have led to this digression as yet are in

their infancy; but, even imperfect and crude as they confessedly at present are, they have already thrown much light on some very obscure parts of animal and vegetable physiology, and they promise to afford much more: they certainly disclose one of the most curious physical forces which have been discovered in modern times, and the just value of which we have not at present the means of estimating.

(38.) The same observations apply, and perhaps with still more truth, to that most curious discovery lately made by the celebrated Dr. Robert Brown, who has shown, by a most unexceptionable series of experiments, that locomotion, even when apparently independent of external forces, may and does exist among particles that are absolutely lifeless; nay, which have never been alive: so that, should not this phenomenon admit some more probable solution, it would seem that the long-established definition, which declares matter to be inert, may perhaps require a serious modification.

This apparently independent motion of the molecules of matter may appear to some to be a close approximation to the vital motions of plants, or the spontaneous movements of animals; and, indeed, the idea would seem more feasible than the belief of some German philosophers, that crystallization is an effect of vitality. The facts are simply these: that grains of pollen, particles of dead plants, some of which have been in herbaria for upwards of a century, nay, even fragments of powdered glass and stone, when diffused through water, and viewed with a good microscope, are seen to be in a constant state of motion; and this independent of any evaporation of, or currents in, the fluid; nay, still to maintain their restless activity when hermetically sealed between two plates of glass, so as to exclude, as far as possible, all external agitation, and are found, even under such circumstances, to continue their motions unremittingly during an indefinite period; nay, even after the lapse of months, (I believe we may now say years,) to be as full of motion as when first observed.

(39.) This discovery, as just now hinted, has been thought by some to militate against the ancient dogma, which enunciates the inertia of matter. It would ill become me to advance any speculations other than as mere hypotheses; and this the more especially as the discoverer himself, with that modesty which always attends true genius, does not even venture a speculation. I, therefore,

scarcely dare to suggest that it would be desirable to ascertain whether these movements may not be indicators of external motions, so slight as to be imperceptible to other means, rather than as inherent in the particles themselves. Just as many atmospheric changes are notorious with the water, that are utterly inappreciable with the mercurial barometer: and as the expansions of bodies by heat, and the vibrations of sound, are measurable by some instruments, which are imperceptible by others; so it would be desirable to ascertain whether the motions of these molecules do or do not depend upon vibrations, otherwise imperceptible, communicated by distant moving bodies to the surface of the earth, or to the matters on which they stand; or whether it is possible, as some of the movements seem very constant and similar, that they can evidence the motion of the earth itself, and thus afford the means of constructing a delicate *kineometer*.

(40.) But although many pseudo-*animalculæ* and (if we may be allowed the parallel word) *vegetalculæ* (?) are thus shewn not to be *those* wonders they were once supposed to be, and although locomotion is thus proved not to be absolutely diagnostic of life, still they are not the less wonderful now that they are regarded as what they truly are, lifeless corpuscules, put in motion by newly discovered and extraordinary laws, which their observation has been the first to reveal, than when they were considered paradoxes, and almost a reproach to natural science. And besides, even after their exclusion from the organic realm, there still remain many living beings, as simple in their structure and as curious in their functions as imagination can well conceive a vital organization to be, or ever to have been.

(41.) For example, the slimy matter often seen on rocks and stones, on hard gravel walks, and on damp walls and cellars, or on the glass of windows, garden pots, and so forth, and which is often so minute as to be lost to ordinary vision, consists of curious and most admirable vegetable structures. All the green pulverulent coating seen on old trees and palings is also found, by microscopic observations, to be composed of an infinite number of small plants, of an exceedingly primitive formation.

[Vide "Outlines of Algologia," sections *Nostochinæ*, *Fragillinæ*, *Byssinæ*, &c.]

Chlorococcum murorum.

a, natural size,

b, granules magnified.

This is the Protococcus viridis of Agardh. It was first discovered in this country by my friend the Rev. J. M. Berkley, on the walls of Christ's College, Cambridge, and figured by Dr. Greville, who has shewn it not to be a protococcus, but a chlorococcum.

(42.) The slimy masses known as Will o' the wisps, or Nostocs, are instances of other allied species, some of which are called by the common people " flowers of heaven;" a name which they deserve more than many that are often given to plants, if it be true, as the old herbalists declare, that, " infused in brandy, they cause a disgust to that liquor in those who drink of it;" for, as Johnston adds, they would then become " an excellent remedy for the '*potatores summi.*' "

(43.) Not one of the least curious of the lowly flags is the " red snow," which excited so much attention on Captain Ross's return from the North Pole in 1819. This phenomenon seems in some cases to depend upon the sudden appearance of a very minute plant, which the microscope declares to consist of small cells filled with a red fluid, and which is referred to a genus named, from its very simple structure, " *Proto-coccus.*" This plant, as well as the Palmella cruenta, or gory dew, Lepraria kermesina, or bloody rain, with many others called reeks or earth-sweats, as well as certain minute animalculæ, will sometimes suddenly appear in such great abundance as even to tinge pools of water with the hue of blood, to make red stains on the sea shore, and to discolour considerable tracts of ground, so as to simulate red snow, or dew or rain; and such in fact the appearance is vulgarly supposed to be. These occurrences are often regarded by the ignorant as of sinister omen; indeed, whole towns have been occasionally alarmed with the report, that, in the course of a single night, the water of their pools had become changed to

blood; and the dismay was not relieved until a philosopher exhibited to the eyes of many the minute corpuscules which had wrought the change of hue, and which were easily separable by filtering the fluid.

(44.) Palmella cruenta, or gory dew, is common in many places: I found it abundantly, during 1831 and 1832, at Oxford; and it is frequently observed in damp situations, forming "broad indeterminate patches of a deep rich purple, with a shining surface, as if blood or red wine had been poured over the stone or ground." "During dry weather it contracts, grows dull, and disappears; but after rain spreads anew, resumes its sanguine colour, and becomes conspicuous even to vulgar gaze. Its history affords (says Johnson, in his Berwick Flora,) an easy explanation of a phenomenon considered supernatural by monkish chroniclers, and to which Drayton, in his notes to Polybion, refers. "In the plain near Hastings, where the Norman William, after his victory, found King Harold slain, he built Battle Abbey, which at last (as divers other monasteries) grew to a town enough populous. Thereabout is a place which, after rain, always looks red, which some have attributed to a very bloody sweat of the earth, as crying to heaven for revenge of so great a slaughter."

(45.) But not only have we at times showers of the so-called red or bloody snow, rain, &c., and gory dew, ice, and so forth, produced as above explained, but occasionally these storms and dews are found of different colours, as green, blue, and yellow. These analogous phenomena are owing to plants not very different in their nature: the blue to *Byssus cobaltiginea*, the green to *Palmella botryoides*, the yellow to *Lepra candelaris* or *chlorina*, and other tints to other plants. "Both snow and ice were seen stained with red, green, and blue, by the late expedition, under Baron Wrangel, to the Frozen Ocean," (N. L. S.;) and Humboldt says, that red hail has been seen to fall at Paramo de Guanacos, on the road from Bogota to Popayan. Agardh, in an interesting memoir, mentions several of these supposed preternatural occurrences, that in different ages have been recorded; some of which have been looked upon as direct signs of the anger of the Deity. The learned professor observes, that red snow is very common in all the alpine districts of Europe; where it is, most probably, of the same nature as that brought from the north pole by Captain Ross. Saussure saw it in

abundance on Mount Brevern, in Switzerland, frequently among the Alps, and elsewhere; Ramond found it on the Pyrenees, and Sommerfeldt in Norway. In March 1808, the whole country about Cadore, Belluno, and Feltri, was in a single night covered to the depth of twenty centimetres, with a rose-coloured snow; at the same time, a similar shower was witnessed on the mountains of Veltelin, Brescia, Krain, and the Tyrol. A similar one occurred at Tolmezzo, in the Friaul, between the 5th and 6th of March, 1803; and, on the 15th of April, red snow fell on the mountains of Toual, in Italy. But the most remarkable red-snow shower on record was that which fell on the night between the 14th and 15th of March, 1823, in Calabria Abruzzo, in Tuscany, and at Bologna; consequently, along the whole chain of the Apennines.

Agardh considers this remarkable substance to be referable to the lowest order of the Algæ, and to stand as a distinct genus, which he calls *Protococcus*, upon the very limits of the animal and vegetable kingdoms. Saussure, indeed, by finding that the red snow of the Alps gave out, when burnt, a smell like that of plants, concluded that it was of vegetable origin; but he supposed it to consist of the farina of some plant; although he could neither account for its having ascended to such elevated regions, nor mention a plant whose farina is of that colour.

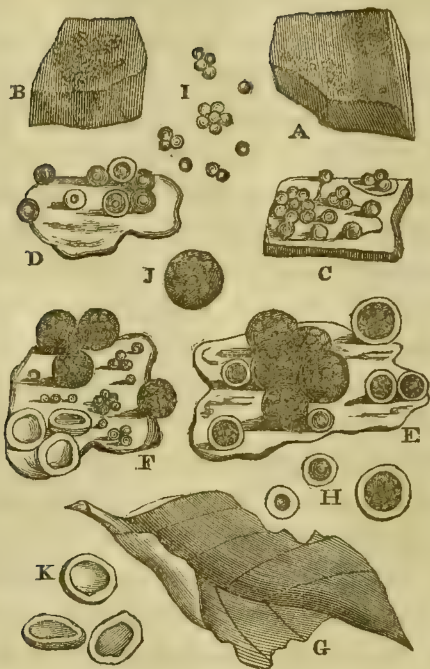
"Besides the (gory dew) *Palmella cruenta*, which is similar in its structure to the red snow plant, other low vegetable productions have been noticed by different authors as possessing a similar colour: such are the *Lepraria kermesina*, which, by the way, is considered only a particular state of the red snow plant itself, and the *Byssus cobaltiginea*. These are always found in situations in which they are exposed to the intense action of light, such as vast plains of snow, or masses of glittering limestone; whence it is inferred, that the colour of the red snow is attributable to the action of light, modified, in some mysterious manner, by the nature of the body on which it strikes: in confirmation of which hypothesis, it is remarked that, when Lepraria kermesina is found under the stems of trees, stones, or in the crevices of rocks, where light can scarcely gain admittance, its colour gradually passes from red to green.

"The chief difficulty in the way of this explanation of its nature, is in the statements of so many observers, that the red snow falls from the air. Professor Agardh, however, attempts to parry this by

shrewdly remarking, that, as all the persons who mention its fall agree that *it fell in the night,* such a statement is as much as to say that *no one saw it fall.* He is of opinion, that the Protococcus, or red snow, is called into existence by the vivifying power of the sun's light, after its warmth has caused the snow to dissolve, and accompanied with that incomprehensible power in white snow of producing a colour; and, moreover, that it first attracts the eye when there is a considerable quantity, in the same way that we do not see the colour of the drops of water till they have accumulated in the ocean." (*News of Literature and Science.*)

(46.) Notwithstanding the ingenuity of Agardh's reasoning, it appears to me much more probable that the red snow does really sometimes fall, and that the small plants of which it consists are at at least occasionally of atmospheric growth: for, allowing the Professor's argument its full strength, and allowing that the showers have been chiefly nocturnal, and that they have first been observed early in the morning; and disregarding the evidence of those who state that they have been *seen* to fall, the sudden appearance of the plants over such immense tracts of country as "along the whole range of the Apennines" can scarcely be accounted for by progressive propagation, however rapid, or by any other means than their aerial transportation. That such migration is probable, will be admitted by all who know that the propagating organs of these plants are of extreme minuteness, that they evaporate like steam, and rise like smoke and dust into the air; in the different strata of which they may float, and be borne about by winds, until the cellules have absorbed so much atmospheric moisture as to be of a greater specific gravity than the medium which has hitherto borne them up. This view will likewise account for their inclusion in the red hail, the appearance of which is otherwise unexplained; for that *it* falls is without question: and that there are situations which will afford abundant migratory supplies, is evident from Captain Ross's statement, that the mountains he found covered with red snow are about eight English miles in length, and six hundred feet in height. The red snow he also observed to penetrate, in some places, to a depth of ten or twelve feet; and he says, it seemed to have existed long in the same state.

(47.) There are excellent figures of the red-snow plant, both in Brande's "Journal of Science" and Greville's "Cryptogamic Flora:" the latter, however, being the most satisfactory in its details, has been the authority to which we have deferred.



A, B. Proto-coccus nivalis, or red snow, on blue and pale limestone, from the island of Lismore.

G. Ditto, on a leaf, from the same place, both natural size.

C. A group of globules.

D. Globules, with their subjacent gelatine, or *thallus* removed from the stone.

E. Mature globules, mixed with younger ones.

F. Mature globules, some entire, some burst, and the escaped granules lying on the slimy thallus.

H. Young globules, of different ages.

I. Granules more or less magnified.

J. Full-sized globule.

K. Globules after the granules have been discharged.—Grev. C. F. 251.

(48.) These simple plants, some of which constitute the so-called red snow, and hail, and rain, and dew, and others, which consist of one or several cellules, distinct or coadunate, give way to more advanced and regular structures in the *Confervinæ*, or *Boneworts;* and these, again, to the higher grades immediately contingent, known familiarly as sea-weeds, lavers, or kelp-ware.

(49.) The Sea-weeds, or Fucales, are followed by the land-flags, *Lichens* or *Lichenales,* which latter have been called *Algæ aëriæ,* to distinguish them from their aquatic allies; and, as they affect a very different station, they exhibit, as they leave the water, several important modifications of structure, to fit them for the peculiar functions they are destined to perform.

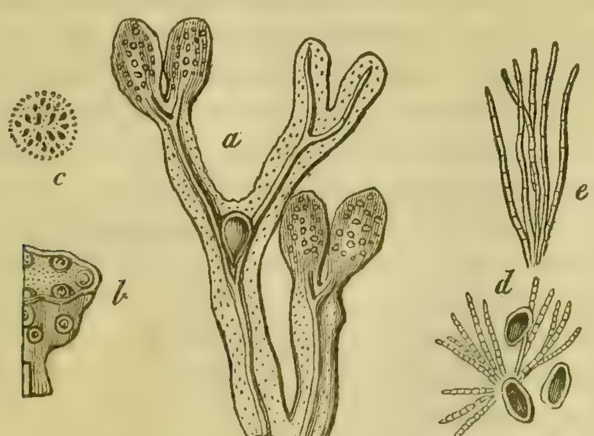
(50.) The *sea-weeds,* or *wrack-worts,* (Fucales, Phycæ, or Thalassiophyta,) including the Lavers (Ulvinæ,) and the Kelp-ware (Fucinæ), are generally water plants, scarcely ever growing in situations that are not frequently submerged. The *lichens,* on the contrary, are as universally aërial plants, affecting often peculiarly arid sites; fixing their shield-like bases on bare and barren rocks, or dead but not rapidly decaying timber; and, when growing upon living trees, not deriving nourishment therefrom. Hence being what are physiologically termed Epiphytes, to contradistin guish them from the true parasites, such as fungi, which not only

grow upon, but draw their nourishment from, the other vegetables to which they are attached.

The marine Algæ were formerly, for the most part, included in the single genus Fucus, as the land-flags were in the single genus Lichen, but the groups of species are in both as generically distinct as in any equivalent orders of terrestrial plants; and hence they are now considered and named as such. The aquatic flora, so long neglected,—that, what was formerly considered knowledge can be regarded as little more than a veil for ignorance,—has, by modern research, been already made a very important and interesting branch of study; and it promises to become much more so, as they well know who ever have explored the vegetation of the sea, and all will soon confess, who shall, like us,

> "Still tread, from rock to rock, in pleasing trance,
> And note the novel forms that deck the sides
> Or float upon the surface; too fair
> Either to be divided from the place
> On which they grow, or to be left alone,
> To perish in their beauty."

(51.) The history of the Fuci, as yielding iodine and kelp, two such valuable articles in medicine and commerce, affords an instructive lesson to those persons who hastily and presumptuously condemn all things as useless, the use of which they know not: for



Fucus vesiculosus, or Bladder-wrack.

(*a*) Upper part of the frond, with several terminal conceptacles.
(*b*) Section of a conceptacle.
(*c*) A globular mass of spores and filaments removed from the conceptacle
(*d*) The filaments and spores still further magnified.
(*e*) Filaments that issue from the pores of the frond.

that very weed confers great benefits on man, who for ages stigmatized it as the synonyme of things most vile and worthless, useless and dispised. "Alga *inutilis*," exclaims an ancient poet; "*Vilior alga est*," in a tone of contumely, he adds; "*Refunditur alga*," repeats another bard; the sea itself spurns forth the worthless flag: that flag, the gathering of which for years enriched both peer and peasant on our northern coasts; the very flag that now affords the iodine which really does relieve that evil which the *manus regalis*, the boasted royal touch (if it ever benefited the superstitious) so long has failed to cure.

(53.) The LICHENS are plants familiarly known even to the least observant, as giving much of the venerable air of antiquity to aged trees, by covering their broken limbs, and reconciling the beholder to the deformity of decay. They likewise impart that subdued appearance and softness in colour and in outline which renders ancient buildings, by their calm grandeur, peculiarly impressive: hence, in our language, often so admirably expressive, they have been called "*time-stains;*" a name which may vie in force and elegance with any that in any other tongue they have hitherto obtained, and which, though long all but obsolete, may well demand its restoration to general favor.

The lichens afford several valuable dyes, a few drugs, and occasionally some food to man, though much more to certain beasts: for example, the *Cenomyce rangiferina*, or rein-deer moss, is the chief support of the Lapland herds. But the immediate uses made of these plants by us are insignificant, indeed, when compared with the functions they perform in the general economy of nature: here their utility is vast, and their value may almost be stated to be in an inverse ratio to their size.

(54.) Linnæus called the Algæ, *Vernaculi*, or bond slaves, regarding them as being fettered to the rocks on which they grow. The title is particularly appropriate, and especially when applied to the lichens, which are, as it were, chained to the soil they labour to improve for the benefit of others, though from it they derive no nourishment themselves.

The first conquests of life over death, the first inroads of fertility on barrenness, are made by the smaller lichens, which, as Humboldt has well observed, labour to decompose the scorified matter of volcanoes and the smooth and naked surfaces of sea-deserted rocks, and thus to "extend the dominion of vitality." These little plants

will often obtain a footing where nothing else could be attached. So small are many, that they are invisible to the naked eye, and the decay of these, when they have flourished and passed through their transient epochs of existence, is destined to form the first exuvial layer of vegetable mould; succeeding generations give successive increments to the soil, thus forming, from which men are to reap their harvests, and cattle to derive their food; from which hereafter forests are designed to spring, and from which future navies are to be supplied.

But how is this frail dust to maintain its station on the smooth and polished rock, when vitality has ceased to exert its influence, and the structure that fixed it has decayed? This is a point which has been too generally overlooked, and yet which is the most wonderful provision of all: the plant, when dying, digs for itself a grave, sculptures in the solid rock a sepulchre in which its dust may rest. For chemistry informs us that, not only do these lichens consist in part of gummy matter, which causes their particles to stick together, but that they likewise form, when living, a considerable quantity of oxalic acid; which acid, when by their decay set free, acts upon the rock, and thus is a hollow formed in which the dead matter of the lichen is deposited. Furthermore, the acid, by combining with the limestone, or other material of the rock, will often add an important mineral ingredient to the vegetable mould; and not only this, the moisture thus conveyed into the cracks and crevices of rocks and stones, when frozen, rends them, and, by continual degradation, adds more and more to the forming soil. Successive generations of these bond-slaves successively and indefatigably perform their duties, until at length, as the result of their accumulated toil, the barren breakers, or the pumice plains of a volcano, become converted into fruitful fields.

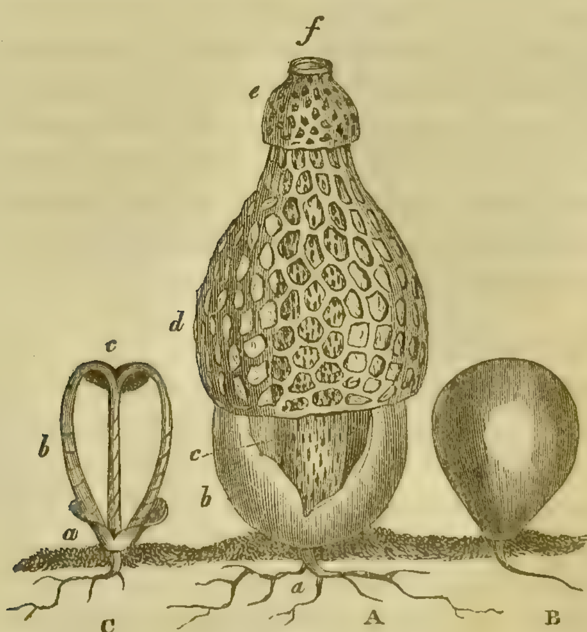
MUSHROOMS, OR FUNGI.

(55.) The Fungi form a large and very curious and important class of vegetables, differing little in the lower grades from several types of Algæ, and, indeed, often considered as of inferior rank in the general scale of creation. They are simple in their structure and rapid in their growth, and, although parasitic, for the most part grow upon lifeless organic matter, which they rapidly decompose, and speedily remove; thus making what has become useless to itself useful to its survivors. For these duties

they are peculiarly fitted by their wandering habits, whence, by Linnæus, they were figuratively called *vagrants*, or "Nomades." On weak and sickly plants these parasites abound; hence, they are often supposed, as blights and blasts, to produce the diseases they attend. They likewise flourish most luxuriantly amongst refuse matters, muck, and offal; and often in great part form what is called mustiness, mouldiness, or mildew: hence, indeed, they have been named respectively Brands, Musts, Moulds, Mildews, Mushes, Mushrooms, &c.

(56.) The botanical term *fungi* (a word which has now, very properly, become almost naturalized to our tongue,) is peculiarly expressive of the functions these plants perform, whether it be immediately derived from *funus* and *ago*, as indicative of their office, the removal of the dead, or intermediately from *fungor*, to discharge or execute a duty.

(57.) The natural history of these plants is one replete with interest and wonder, and, notwithstanding the little attention they commonly excite, they are constantly labouring for the general advantage. The quickness of their growth is astonishing, and the rapidity of their increase all but past belief. The Phalli, the structure of which is so curious as to seem almost paradoxical, extend themselves in height six inches within an hour. The Bovista, or



A. Phallus indusiatus.
a. Root.
b. Volva, or wrapper.
c. Columella, or stipes.
d. Veil.
e. Pileus, or cap.
f. Central channel, running through the plant.

B. Young Clathrus, enclosed in volva.

C. Laternea triscapa.
a. Torn volva.
b. Trifid stipes.
c. Pileus.

bull-puff-ball, has been computed to grow at the rate of many million

cells per minute, upwards of a million per second; and to be, when at maturity, so many times larger than when beginning to germinate, that figures shrink from the expression of the sum. Furthermore Fries asserts that he has counted, in a single individual plant of the smaller kinds, called smuts, 10,000,000 sporules, so subtile that they rise into the atmosphere like smoke; and hence, although lost in astonishment at their prolific powers, our wonder ceases that they should be everywhere dispersed, and colonize every spot that affords fit nutriment for their growth.

(58.) The *Fungi* are associable into three chief groups or orders. The first includes those known familiarly as blights, blasts, and mildews, called collectively the *Mucorales*, (the Hypho- and Coniomycetes of some writers); the second, the puff-balls, truffles, and other tuberiform fungi; hence named the *Tuberales*, (Gastromyci, or Gasteromycetes;) and the third, the common eatable and poisonous mushrooms, toadstools, &c., the *Mycetales*, (the Hymenomyci, or Hymeno-mycetes, of many systems.) But of each of these in turn hereafter.

MOSSES, OR MUSCI.

(59.) The mosses, *Musci*, (using the term in an extended sense, though far less vaguely than formerly was done, when almost every thing moist and soft was called a moss,) will include in one class, along with the frondose mosses, or moss-worts (Bryales or Muscosæ), the *liver-worts* (Hepaticales or Hepatici), and the

A B

A. Jungermannia ciliaris, one of the liverwort mosses, or Hepaticales.
B. Bryum undulatum, a frondose moss, one of the Bryales.

stone-worts (Charales), orders which, although sufficiently distinct, have several important characters in common, by which they are associated together more naturally than either with any other class.

(60.) The liverworts (Hepaticales), which now are classed with the mosses, were formerly considered more nearly connected to the flags, and, indeed, by Linnæus, they were denominated Algæ hepaticæ; and the curious stoneworts (Charales) have likewise in general been separated too widely from their natural allies, whether arranged with the Confervæ or with the Ferns. From the latter they are distinguished by their simply cellular structure, and from the former by the evolution of a distinct axis of growth, around which central line various processes, as leaves or branches, are arranged. These characters associate them with the Musci, which thus exhibit, by their more elaborate forms, a further stage of vegetable development. Still it must be confessed that the Charales are apparently the least normal of the group; yet they seem to stand more fitly here than elsewhere, being an osculant or connecting link between this region and the next.

(61.) The uses of mosses are great in the general economy of nature. Well have they been called, by Linnæus, her ministers, (Servi,) filling up, as they do, and consolidating bogs, clothing mountains even to the verge of perpetual snow, and condensing the moisture of the atmosphere; thus giving origin to rills, and being the living fountains of many streams: but of their functions more hereafter.

(62.) With the Mosses, the first region of the vegetable reign concludes, in which the three classes, Flags or Algæ, Funguses or Fungi, and Mosses or Musci, are included; three classes which, although essentially distinct in the more highly developed and normal genera of each, are still, on their confines, scarcely distinguishable from each other. The simply cellular structure of the whole is their chief bond of union: in this they all agree; and future investigations will show it to be a most important diagnostic sign: hence they have been called Cellulosæ or Cellulares.

(63.) Furthermore, the fact may be enunciated that these vegetables are not reproduced by seeds, and, as they can therefore have no cotyledons or seed-lobes, they have been named Acotyledons; as stated in the tabular conspectus, [§ 21] they are the Musts, Must-allies, or Mosses, of our rustic dialects.

(64.) In most languages it will be found that these lower tribes of plants have originally had the same, or nearly similar, appellations; and that, although their names are different now, the difference often consists in a mere modification of the original term, and that all may be traced to a common root.

(65.) This etymological evidence it would not be right at present to dilate on; but one example may not be irrelevant, to show the general impression which their most obvious characters are calculated to produce.

Our word *moss* (which the Normans gave us for the older *reet*,) is derived immediately from the Gallic *mousse*, a term of exactly similar meaning, when applied to plants, but which also signifies froth or lather, and is itself a derivation of *mou*, *soft* or *loose*, like the foam of the sea or vesicles of lather; analogous to our *must* or *wort*, given to fermenting liquors, and to various similar plants. Hence also sea-weeds, many of which are called *sea-froth*, *sea-foam*, *sea-membranes*, &c., as already shown, are called by the French *mousses de mer*, or sea mosses, the *musci marini* of the older writers, the *βρύον θαλάσσιον* of Dioscorides and Pliny. Furthermore, fungi, or mushrooms, are named *mousserons*, moss-allies; which is, perhaps, a contraction of *mousseronde*, or *round moss*, i. e. soft or puff balls.

(66.) This softness of texture and cellular formation seems to have given names to almost every section. Thus, mouldiness or mustiness is called *moississure* and *mucor;* mildew, like our *mild-dew*, *serein* and *sideratio*, adverting to its supposed deposition from the atmosphere, or belief that the affected plants were star-struck; *mucedo*, *muceo*, and *mucus*, are of nearly similar import to each other, and to our muck or slime; just as *must* in *must-iness*, and *mush* in *mush-room*, are but corruptions of *moss*, or *mousse*. Hence the whole series may be well associated under the common names of *musts* or *mushes*, or *mush*, i. e. moss-allies, technically Myc-affines: their connexions are already intimated by many of their names, such as *muscus*, a moss; *muces*, *mousseron*, or *mouceron*, a mushroom; *mousse de mer* and *βρύον θαλάσσιον*, sea-weeds. Mycinema, a doubtful articulate flag, Cenomyce, and Bæomyces, genera among the lichens, with various others, show a similar affinity to be recognized by other people and in other languages, besides by ourselves and in our own.

FERNS, OR FILICES.

(67.) Linnæus, who viewed nature with the kind affections of a philosopher, and the warm imagination of a poet, gave to the ferns (Filices) the figurative name of *Novaccolæ*, or *new settlers;* and no synonyme could more happily express their habits and general importance. For barren tracts are colonized by ferns long before many other tribes could vegetate thereon; and on sterile soils, where other plants would perish for want of food, the hardy ferns find sustenance enough; consequently, in such situations they flourish and abound, unmolested by loftier and more luxuriant shrubs and trees.

(68.) Ferns are truly colonists, and to fit them for the migrations they are destined to perform, it would seem as if nature, even while developing their organs of vegetation, and giving them both shrubby and arboreous stems, had considerately restrained an equivalent evolution of the reproductive system, lest they should be encumbered by weighty seeds in their successive and continued transits over large tracts of land, and in crossing extensive seas.

A. Cyathea arborea, a tree fern, round which twines

C. Polypodium crassifolium, a scandent fern.

B. Asplenium rhizophyllum, an herbaceous fern with rooting fronds.

D. Equisetum fluviatile, a jointed fern.

E. Lycopodium cernuum, and

F. ———— phlegmaria, suffruticose and trailing ferns.

(Dict. des Sciences Nat.)

Hence, instead of elaborate fruits and seeds, ferns, with the stems and nearly the foliage of palms, have spores little differing

from those of mushrooms and of mosses. Like them, they are most prolific, for a single frond, and one fern bears many fronds, has been computed to produce upwards of a million spores.

(69.) Like the musts and their allies, so minute are the reproductive spores of ferns that their existence was even for a long time doubted, and before microscopes exposed them to our sight, this belief was common, and many references are made to it in our older writers. Shakspeare, in allusion to this then popular opinion, observes, "we have the receipt of fern-seed, we walk invisible."

The final cause of this reduced development appears to be, that such dust-like spores should be easily transportable from place to place; and hence it is that barren heaths, and coral rocks, and new made islands, raised probably by submarine volcanoes, after that lichens and mosses have first subdued the sterility of stone, are colonized by ferns, the heralds of a more luxuriant vegetation, and harbingers of plants more immediately subservient to the purposes of man. And not only is such the course which nature now pursues in the conversion of barren into fertile soils, but geology informs us that such was the scheme of her primæval operations in preparing the earth for the reception of man; for, from the strata in which ferns are found, it is more than probable that they preceded and prepared the way for the introduction of many other vegetables, for the higher animals, and for the human race.

(70.) The peculiar characteristics of the several groups of moss-like, jointless, and jointed ferns, must, from the limits to which an introductory sketch is of necessity confined, be reserved for subsequent explanation; but this need not be regretted, for, as the illustrations successively become more and more familiar, they will of course require, in this bird's-eye view, a less and less elaborate description, and for some a mere nominal reference will probably suffice.

(71.) Hence, the grasses and the sedges, the lilies and the palms, the pines, &c., although much more important plants, as ministering more immediately to the comforts and conveniences of man, will, from their being so much more familiar to all, require far less descriptive detail, than the lower classes of mosses, flags, and fungi; many of which are comparatively so little known, and which seemed, therefore, to demand in this preliminary conspectus, the most particular introduction.

GRASSES, OR GRAMINA.

Saccharum officinarum, the sugar cane; one of the grasses.

A. An entire plant diminished. B. Spikelet of flowers. C. A flower separate. D. Ditto, opened to shew the stamens and pistils.

(72.) The grasses and sedges, though in some features similar to the shave-grass ferns, are as characteristically distinguished by the higher development of their organs of reproduction, as the ferns are by that of their organs of nutrition. In this class it is, that true flowers are first observed, and the fruit no longer developed as spores, but in the form of *grains*. Hence they have been named by some botanists, in reference to their fruit, *Graniferæ*; by others, referring to the husks within which their flowers are found, *Glumaceæ*; and by others again, from their stalks, which are called straws or culms, *Culmiferæ*.

(73.) The grain-bearing, husk-flowered, or straw-stalked plants, of the Botanist, are the grasses and sedges of the farmer. But as these, including in the first-named the cereal species or corn, can no longer be referred to the single *genus Gramen*, GRAMINA should either become the name of the whole order, or, should this seem objectionable, they might be called collectively SEGETES, or *Grassedges*, (Gracarices,) thus avoiding the periphrases Gramina et Carices, Grasses and Sedges; Plantæ Glumaceæ, P. Graniferæ, P. culmiferæ, and so forth.

(74.) The *grasses* pass by the *reeds* and *canes* to the *palms*, the *rushes* and the *lilies*; the *Palmæ* et *Lilia* of the Linnæan scheme; both of which are included in the *Palmares* of our scale.

PALM-LEAS, OR PALMARES.

A. Areca catechu. B. Musa paradisiaca. C. Agave geminiflora.
D. Iris germanica. E. Narcissus poeticus.

(75.) This class, *Palmares*, contains some of the most curious, splendid, and majestic plants existing, which Linnæus called the Princes (*principes*) and Patricians (*patricii*), while he denominated the grasses the Plebeians (*plebeii*) of the vegetable kingdom. The tulip, iris, orchis, and banian types are the pride of our gardens and conservatories; and the palms, although insignificant when grown in our largest houses, still shew, even in confinement, what majestic plants they must be when flourishing unrestrained in the wild luxuriance of desert nature: for some, with erect stems, attain the height of nearly 200 feet; and others, that are climbing palms, are found of 500 feet in length.

(76.) The three classes forming this, the second region of the vegetable reign, include plants possessing a very peculiar and characteristic structure; which, although pervading all, is thought to be (though, perhaps, not altogether correctly) more decidedly developed in the palms, than in the arboreous ferns, the grasses, the sedges, or any of the other sections.

(77.) This structure will hereafter be fully explained, but even now the fact may be enunciated, that anatomical investigations,

in the first place shew, that these plants consist not of cells alone, as in the mosses, funguses, and flags, but of tubes and cells, more or less irregularly collected into fasciculi, which are dispersed in general without reticulations in the leaves, and deposited centrally within the stems. That the stems are covered externally by the squamous remnants of the successive crops of leaves, just as the bulb of a lily is by its scales; that the oldest growths are likewise, as in the bulbs of the lily, tulip, onion, hyacinth, &c., external; and the newer growths mostly internal; so that the parts first formed are gradually forced outwards and distended, until they become so far indurated as not to yield further to pressure from within. Hence, when this hardened girth has once been formed, the stems never after increase in thickness, how much soever they may increase in height.

(78.) From this law of evolution a very important character results; for, as the stems in general can never increase in girth, and the successive crops of fruit and leaves can only be supported by maintaining a communication with the roots, by successive internal deposits of adducent and reducent vessels; so when the first formed cylinder is filled with fibres, year after year condensed, a period at length arrives when, the internal space being filled, no further deposits can take place; and the plants inevitably die. This period is of greater or less extent in different species; but, however great it may be, a limit is fixed in early life to their duration, beyond which they cannot pass. Life being to them but a preparation for death; and the very means by which they subsist, renders their extinction progressively more certain.

(79.) In different palms the diameter thus first formed varies, and the height to which they grow is various likewise; but to whatever extent either may proceed, the one is decidedly the limit of the other; for every additional bud or crop of leaves depositing its fibres in the centre of the stem renders the mass more dense, and more and more confirms the outer ring, which, when filled, will permit no further fibres to descend, and the plant, without redemption, dies: should, however, this cylinder be cut through, or by any means be burst, then the term of existence may become indefinitely extended; and such is the case in the Dracæna; and the celebrated one in Franqui's garden, in the island of Teneriffe, is probably six or seven hundred years of age.

(80.) The general mode of growth being thus internal, has caused the whole region of plants in which it is found to prevail to

be called *Endogenæ*, or inside growing vegetables; as the previous region, from their cellular structure, have been called cellulosæ, or *Telogenæ and Syngenæ.* The term of their existence being fixed during their earliest years, which the very act of growth renders more and more inevitable, and which is strengthened by their strength, may not improbably have led the ancients to apply the name *Termes* to a palm-tree, as well as to the fruit branches of other plants, when plucked, and a period put to their existence: and hence the region in which this peculiar characteristic is found to prevail may be called TERM-AFFINES, as indicative of this, one of the most notorious diagnostic signs.

(81.) Experiments have shewn that some bulbous plants, when freely supplied with water and with abundant food, produce more leaves than flowers, and not unfrequently the blossoms entirely fail: nor is it, until the supplies become diminished, that either flowers or seeds are formed. This is a matter of experience; and gardeners avail themselves of the knowledge to force unwilling plants to blossom, and barren trees to bear. A somewhat similar phenomenon is observable among certain palms, and may not improbably be accounted for on similar principles. For example, the Talipot, with its majestic columnar stem, equalling in height the main-mast of a man-of-war, and bearing annually, through ages, its royal crown of gigantic leaves, never flowers but once. The foliage is luxuriant in the extreme, one leaf being sometimes five and thirty feet in circumference and large enough to cover thirty or forty men: and this very luxuriance in leaves is probably the cause of its continued barrenness in flowers. But towards the close of its existence, and when the stem has become so far indurated that fresh ducts from the terminal buds cannot readily descend,

Corypha Umbraculifera.—The Talipot Palm.

when the supplies of food are curtailed, and its last effort to live brings inevitable death; then the *Corypha* blossoms and its beautiful flowers which smell so strongly that they can be perceived at a great distance, are succeeded by an abundant crop of fruit; one tree yielding enough to supply an entire country: and thus the Corypha, after having lived so long for itself, dies for its posterity.

(82.) It rarely happens among the palms, and not frequently amongst any of the *Term-affines*, that more than the central bud is developed; and hence these plants are seldom branched; and their trunks, when elevated, and no longer creeping stems (rhizomata), are for the most part cylindrical or nearly so. There is no absolute necessity, however, for this abortion of the lateral buds, and hence, occasionally an extra one is developed and forms a branch. In some, as the Theban Doom-palm, (Cucifera thebaica or Hyphæne coriacea,) two buds are naturally and equally developed, so that the stem becomes repeatedly forked (bifurcate.)

(83.) In certain grasses likewise, as the bamboos, the stems are branched, and various exceptions to the general law are known, which hereafter will be detailed, and which circumstances render *Term-affines* a preferable name to *Termites*, the use of which, moreover, is now forbidden from its being appropriated by zoologists to a destructive tribe of ants; and far preferable to either Monocotyledones or Endogenæ, as they are not universally either one-lobed or inside-growing plants.

ZAMIAS AND PINES, ZAPINI.

(84.) *Zamiæ*, or *Zemiæ*, names given by the ancients to the cones of firs, which, being left to open ungathered, they believed to injure the trees and lessen the following crop, have in modern science been devoted to the designation of several curious plants, which, with their allies, the Cycases, connect, by their habit the *Ferns* and *Palms* of the *Term-affines*, with the *Pines* and forest-trees, to which, by their internal structure, they are found to be legitimately allied.

(85.) Hence this first class of the third region, including the *Zamiæ* and *Pini*, may, to avoid a periphrase, be called *Za-pini*, and the two orders it contains, the *Zamiales* and *Pineales*.

A. Abies excelsa.
B. Thuja pendula.
C. Cycas circinalis, male.
D. ——————— female.

(86.) The naked seeds and peculiarly porous wood-vessels, which so closely associate these plants, otherwise at first sight apparently dissimilar, are characters but comparatively a short time known; and therefore, previous to their discovery, the Cycases and Zamias were arranged by some authors with the Ferns, on account of their gyrate vernation,* and by others with the palms, on account of their simple stems.

(87.) But the internal structure of these plants differs greatly both from the Ferns and from the Palms, for although not to the fullest possible extent confirmed, still their growth and annual deposits are decidedly external; they increase in thickness, and the layers of vessels which constitute their wood are stratified, each succeeding year external to those of the preceding; a character which is common to this region, and which forms a strong contrast with the internal growth of the *Term-affines*.

(88.) Hence the plants in this region increase in girth as well as height, and have no determinate period assigned for their duration. These circumstances are indicated by their collective name, *Cres-caffines*, or *cress-allies;* and among them will be found examples of the tallest, the largest, and the oldest vegetables existing.

(89.) From the external growth and exterior deposition of wood, these plants have been likewise called *Exogenæ*, or *outside*

* Curling inwards of the leaves or fronds as in Cyathea, vid. page 18.

growers, and they have also had other names indicative of other characters, to which reference shall be made hereafter.

(90.) Zamias and Cycases, neither being indigenous to this country, nor naturalized to our climate, Firs, Larches, Yews, Cypresses, and Cedars, are among the most familiar examples of the first class of the Crescaffines, which is distinguished from the succeeding, not only by the peculiar structure of the wood, but also by the seeds being naked, i. e. not furnished with an especial covering or seed-vessel, as in the following group: hence their descriptive synonyme, Plantæ gymnospermæ; but as this term has been otherwise, though generally incorrectly used, and, as it is not applicable to these plants alone, perhaps a name compounded of the appellations of the most important genera and orders it contains, may be esteemed more fit to designate the class, such as Zapini, *i. e.* Zamiæ et Pini, as before observed.

By some the *Zamiales* have been called *Cycadeæ*, and the Pineales, *Coniferæ;* but both orders are equally coniferous, while the latter does not include universally cone-bearing plants; hence this is a collective rather than a distinctive term, and as such it has been used, although disadvantageously by others: and therefore it is now proposed to supersede it by the compound appellation above described.

(91.) Pines, which rank among our loftiest trees, are seldom known in this country to exceed a hundred feet in height, such plants are not to be compared with the magnificence of the New Zealand and Canadian species, which tower from one to two, and even to three hundred feet in height, maintaining at the same time a proportionable girth. One tree, indeed, I have had an account of, which grew in New South Wales, which is said to have exceeded 400 feet in height, being higher than the cathedral of St. Paul, (but not being a pine it should rather be mentioned when treating of the succeeding class, were it not as well to collect the chief of the crescaffines together,) and we are told that an American cypress is now existing that measures above a hundred feet in girth.

CRESSELS, FRUGES, OR EUCARPÆ.

(92.) The Herbs and Trees (Herbæ et Arbores) of Linnæus, figuratively called by him the Nobles and Elders, (Nobiles et Proceres,) of the vegetable kingdom, and amongst which he distinguished those bearing arms (such as thorns and prickles) as

Warriors (Milites) that not only thus defend themselves, but also protect otherwise defenceless vegetables from the aggressions of animals, were collectively denominated by Hill, Plants or Plantæ, under which common name he included all those species which were not reducible to any of his six previous classes, Fungi, Algæ, Musci, Filices, Gramina, et Palmæ.

(93.) But the plants of Hill, thus negatively defined, formed such an extensive group of faintly characterized and heterogeneous sections that the term *plant*, instead of being restrained even to the extent that he designed, has long been used as a synonyme for vegetable; and the herbs and trees both of Linnæus and the older writers, are so inseparable, and (as systematic groups) so ill-defined, that the words are now indifferently employed, in almost every class, merely to distinguish the larger and perennial, from the smaller and more transitory species.

(94.) Hence reformation was greatly needed here, and the group has been entirely remodelled and recast; many sections have been excluded, and other arrangements made. But, notwithstanding these exclusions, the class still remains very large; yet, though extensive, it is now well characterized and easily defined. For the seeds, instead of being naked, as in the Zamias and the Pines, are invested with a peculiar covering called a pericarp, or seed-vessel, and known commonly as the fruit; such as the fleshy part that is eaten in the melon and the peach, the shell or pod that is thrown away in the nut and the bean. Hence by some botanists these vegetables have been called *Exogenæ Angiospermæ*, or *seed-vesselled*, to contradistinguish them from the *Exogenæ Gymnospermæ*, or *naked-seeded plants*. Richard and Bartling, who regard other characters as more distinctive and important, call them *Exorhizæ* and *Gymnoblastæ*. But we had rather name them, with special reference to the high development of the fruit and seed, *Fruges*, or *Eucarpæ*. Indeed, this latter change seems necessary, from the exclusion of the plants which form our seventh and ninth classes, which we think improperly blended, whether with the Angiospermæ, Gymnoblastæ, or Exorhizæ, by the botanists who use those names.

(95.) The gymnospermous Pineales being excluded on the one hand, and the evascular Rafflesias on the other; the *Eucarpæ* or *Cressels*, much as they may differ, and much as they do vary in size and in duration, are mostly coincident in their radiate and stra-

tified structural arrangement; and all in the exogenous disposition of their tubes and cells, by which characters they are distinguished from the *Selanthi;* and in the constant development of a seed-vessel at some period of their growth, by which they are known from the Zapini.

(96.) Amongst the *Fruges*, or *Eucarpæ*, are found many of our culinary vegetables, known commonly as cresses, and some of the most elegant of our garden plants: hence, as a distinction, they might familiarly be called *cressels; sel*, as in *sel*ago, ground*sel*, &c., indicating worth or beauty.

(97.) To illustrate plants so well known seems almost a work of supererogation; and yet not to cite examples from such an important and extensive series, might appear to be unpardonable neglect.

Although agreeing in their common and essential characters, in no class is there exhibited a greater diversity in the subordinate developments and the secondary modifications: and hence these plants are distributable, and have been distributed, into very numerous types and sections. These will hereafter be described; it is the general character of the classes and the regions that, in this introductory subjective outline, we chiefly desire to illustrate.

Let, therefore, the Oak, the Chesnut, and the Baobab, as being

Golyno's Oak.

the most familiar and noble, serve now as sufficient illustrations. For these, besides by their covered fruits exemplifying the class,

will, with the fir, the yew, and the cypress of the Pineales, mark most strongly the all but unbounded size to which the *Cresc-affines* may increase, and the almost indefinite term of their duration.

(98.) In my "Amænitates Querneæ," I have collected many records of extreme size and age in trees, especially in oaks; several of these are British, and some are still existing. Perhaps the Tortsworth, the Salcey, the Allouville, and the Cowthorpe are the most interesting and curious examples. The first-named measures fifty-two feet, the second forty-six, and the last, at its lowest level, seventy-eight feet round. Baobabs, however, have been described still larger: Adanson measured several varying from seventy-four to seventy-seven feet in circumference; and Perrottet and Golworthy mention having found them of ninety, and occasionally even exceeding one hundred feet in girth.

(99.) The ages of several European trees, especially chesnuts and oaks, have been satisfactorily traced by records through many centuries, and of that of others a fair estimate can, in some cases, by other means be formed. Thus, the old chesnut of Tortsworth is known to have numbered above seven hundred, and is calculated to have lived upwards of a thousand years. The age of the Salcey oak has been computed at above a millenium and a half; the oak of Allouville is believed to be between eight and nine hundred years of age; and the Cowthorpe oak is probably more than twice as old. But what then can be the probable age of the still larger Baobabs?

(100.) Of the natural history of these enormous plants too little is at present known to allow any positive deductions to be drawn from their size alone: but still calculations have been made, although not on wholly unexceptionable data. It is with the *degree*, however, that I am less satisfied than even with the *kind* of evidence adduced. Furthermore, I do not think that the observations have been made with sufficient care: for trees increase very irregularly in the several radii of their diametric bulk; and if three hundred rings, measuring, say three feet across, be granted to be the produce of three centuries on one side of a certain tree, and that an injured or wounded side, this fact alone cannot warrant the conclusion that three feet of the diameter measured on the other or unwounded side, or in another tree, have likewise been three hundred years in forming.

Adansonia digitata.—The Baobab.

We do not mean to say that the evidence is bad in principle, but that not enough has been afforded for reducing it to practice; and yet on such evidence it is by some botanists of celebrity asserted, that the smaller Baobabs are a thousand, and the middling-sized ones above two thousand, years of age; and hence, forsooth, that the largest which have as yet been found (exceeding one hundred feet in girth,) must have lived for upwards of fifty centuries at least. The portrait of one of these majestic Baobabs, which is given in Macartney's Embassy, whence the accompanying figure has been taken, is one of those upon which some such calculations have been founded; and yet it would seem from its geminate trunk, to be an instance of all others peculiarly unfitted for generalization.

(101.) But however this may be, it is for the purpose of our present illustrations, a matter of comparatively little moment: for, whether the Baobabs have numbered quite so many years as their admirers contend or not, their antiquity, doubtless, is extreme, and their sturdy dwarfish stature, as they seldom exceed sixty or seventy feet in height, must favour their almost indefinite duration. Their age, even at the lowest computation, will form a striking example of that one great characteristic of these plants and their allies, the structure of which sets naturally no limit to their existence: and hence it is that they have been called the *Cress-allies*, or *Cresc-affines*.

(102.) It must not, however, for a moment be supposed that all the plants included in this region are essentially so long-lived, for

many are quite ephemeral; but, however long or short a period they endure, their structure is similar to that of the most long-lived species; and, unlike those included amongst the Termaffines, there is nothing in their mode of growth physiologically incompatible with indefinite duration. But it is time that some further account be given of the examples already cited.

(103.) Seven hundred years ago, the "great chesnut of Tamworth" was referred to in writings still extant, as a signal tree; and if, in the reign of King Stephen, A. D. 1135, it was called *the great chesnut*, it is more than probable that it has bounded the manor of Tamworth (now Tortsworth,) for upwards of a thousand years. Some time since it measured fifty-two feet in circumference; and, from calculations that have been made, it is believed that in its youth it must have been contemporary with the Saxon Egbert. I have lately made inquiries concerning the state of this venerable tree, and learn, with satisfaction, that it is not only still alive, but flourishing in its "green old age," and, from the vigour its shoots evince, it will probably outlast the present generation.

The accompanying figure is of a chesnut of still more enormous growth, and probably of still more lengthened years: it is the celebrated Castagno di Cento Cavalli, the monumental ruins of

which still exist on Etna. A traveller of credit reports this tree to measure, round those isolated parts, which were evidently once in union, a hundred and sixty feet. So capacious is the cavity of

its enormous shell that the peasants have built a house within it, where they have an oven for drying chesnuts and other fruit; and, with an ingratitude which, however, is not without a parallel, they often supply themselves with fuel from the sylvan patriarch that surrounds and shelters their abode. By some persons this chesnut is said to have been capable of containing, or rather perhaps of overshadowing, a troop of a hundred horsemen; and it is reported to have received its name of "the hundred-horse tree" from having afforded shelter to Jean of Arragon, and her attendant nobility, amounting to that number, who were overtaken by a storm on Etna. It is well known that she passed some time in Sicily, on her way from Spain to Naples. But it is not improbable that the word *cento* is here employed indefinitely, as *forty* was by the Jews, and *score* still frequently is by us, to express a *multitude* or *many*, rather than any precise or definite number.

(104.) The oak of Allouville, in Normandy, known there as the *Chêne Chapelle,* and to which reference has been made, was, above a century and a quarter since, converted into a place of worship. Its trunk was at that time hollow, and its head in part decayed. This living cavern was then paved and roofed, and divided by a floor into two apartments: the lower was fitted up by the Abbé du Détroit as a chapel, and the upper as a chamber for the officiating priest; who thus, like a second Stylites, might dwell aloft in the wilderness alone.

(105.) The caverns in hollow oaks are, however, seldom devoted to such honourable purposes: that in Damery's for years was used as a tavern; in the prison-oak at Kidlington, vagrants and other slight offenders are said to have been occasionally confined; and the shell of the venerable Salcey patriarch, which is nearly half as large again as the chapel-oak, was formerly enclosed by gates on either side, and cattle penned within it; and so capacious is the hollow of the Cowthorpe oak, that upwards of seventy persons have been, as the villagers affirm, at one time therein assembled.

(106.) Were it not, as I elsewhere have observed, for instances such as have now been mentioned, (some of which occur in our own country, and in our own or our fathers' time,) we might almost be allowed to treat as fables the tales of modern travellers, who tell of trees converted into tanks, and tombs, and prisons; as well as those older histories, which declare that the ancient Germans made castles of oaks; that in one vast cerrus a hermit built his cell and

chapel; and that another "served both as a castle and a fort." Of these stupendous oaks the history would almost seem to be as monstrous as their reported bulk; but that a hollow oak might be sufficiently large for a hermit's cell and chapel, we have existing proof in the oak of Allouville; and it may be also well conceived, when we reflect that the cavity in Damery's oak was three feet wider than the parish church of St. Lawrence, in the Isle of Wight; and that the trunk of the Cowthorpe oak, just noticed, where it meets the ground, stands on a plot exceeding by more than six feet the length, and by two feet twice the width, of the parochial church just mentioned.

(107.) Few persons, indeed, save those to whom habit has rendered it familiar, form any thing like just estimates of the actual size of trees. The situations in which they commonly are seen, harmonizing with the illimitable expanse of heaven, and the wide extent of forest scenery or of mountain heights, lessen ideally their apparent bulk: nor is it till singled from the surrounding landscape, nor even then, until the theodolite and rule proclaim their sums, that we become persuaded of their vast extent. Nay, figures themselves, to the generality of the world, convey but very imperfect conceptions of length, and breadth, and height, and girth: some more familiar representations are wanted to prove that a majestic tree, which is only in moderate proportion as an ornament to nature in the country, is really an enormous mass, and would be esteemed a large and glorious structure amongst the dwellings and palaces of men, in town. It is by comparing these forest kings with more homely objects, that we alone become acquainted with their correct capacity. When seeing an oak seven feet in diameter, its size arrests not our attention; we even pass with little thought such as hold ten or twelve feet across, or more, although the smallest of these has a width as great as the carriage-way of Fetter lane, near Temple bar, or of Bedford street, in the Strand. Oaks could be named which would suffer two broad-wheeled waggons to pass each other on the kerf; the stub of one has been described on which two men could thresh, without incommoding each other; and this was not one of the largest size. The chapel-oak of Allouville, not half so large as our Cowthorpe tree, is of equal size with the famous Greendale oak, the trunk of which is pierced by a road, over which it forms a triumphal arch, higher by several inches than the entrance to Westminster Abbey

(the Poet's Postern), and under which men on horseback pass, and through which carriages have been driven.

(108.) The area occupied by the Cowthorpe oak, where the trunk enters the soil, exceeds the groundplot of that majestic column, of which an oak is confessed to have been the prototype, viz. Smeaton's Eddystone lighthouse. Sections of the stem of the one would, at several heights, nearly correspond with sections of the curved and cylindrical portions of the other. A chamber of equal extent, or larger than either of those in the lighthouse, might be hollowed out of its trunk; the natural caverns in Damery's and other oaks were larger than the chambers alluded to; and transverse slices of the stem would be considerably too large to floor any of them. Arthur's round table, which is a plank from such an oak, would form for it an entire roof, or projecting capital: indeed, upon this table there might be built a round church, as large as that of St. Lawrence before referred to, and space to spare; so that, if the extent of the sapwood were added, or the groundplot of the Cowthorpe oak were substituted for the table, there would be plenty of room, not only to build the parish church, but also to allow enough for a small cemetery beside. Indeed, with reference to this last-named oak, and also the tree-castles and tree-chapel, I would merely observe, that St. Bartholomew's, in the hamlet of Kingsland, between London and Hackney, which, besides the ordinary furniture of a place of religious worship, viz. desks for the minister and clerk, altar, staircase, stove, &c., has pews and seats for one hundred and twenty persons; upwards of one hundred have been in it at the same time; and some months since, myself made one of a congregation there assembled of nearly eighty persons, (seventy-six or seventy-seven were counted,) when the pews were by no means crowded, and plenty of room left vacant. Still this chapel is nearly nine feet less in width, and only seventeen inches more in length, than the groundplot of the Cowthorpe oak: in fact, the tree occupies upwards of thirty square feet more surface than does the chapel. Or, to take another illustration, in Little White Lion street, Long Acre, the inspectors of a district visiting society found, some months ago, a house, the internal area of which is only twelve feet by twenty-four, (not half that of the Cowthorpe oak, which is twenty-six feet in diameter,) containing nine small rooms, in which there dwelt—i. e. eat, drank, and slept, and did all that poor mortality requires,—no less than eleven men,

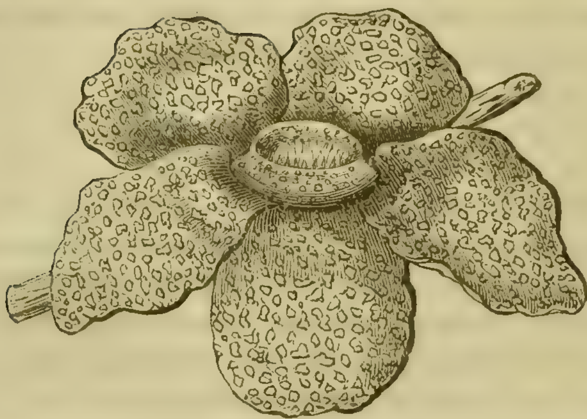
thirteen women, and sixty-nine children, making a total of ninety-three human beings, who have been crowded into less space than is enjoyed by a single tree, (Amænitates Querneæ.)

SELWORTS, OR SELANTHI.

(109.) The next and concluding class is formed by the *Selanthi*, or *Selworts*. These plants, like the *Pineales*, were until lately blended, some with the Fruges or Eucarpæ, and others with the Palmares; but, although still less in number as yet are known, those which have been discovered and examined constitute a group as structurally distinct, or more so, than even the Zamiæ and Pini; for, in the Selanthi, the vegetable kingdom, after proceeding through many successive stages of development, from seedless to flowering plants, exhibits a return to the point whence the series of evolutions began. They seem, in fact, to form the descending links which connect the highest with the lowest grades of vegetable development.

(110.) By their flowers, sometimes evolved in a most exuberant degree, they establish their connexion with the highest flowering plants; while, by their destitution of tubular vessels, and their frequently fungoid characters, they show their close affinity to the lower mushroom sections.

(111.) Some of these plants, such as the Cytinus, &c., have long been known, and, from their paradoxical structure, regarded as anomalies and exceptions in the classes to which they were formerly referred. But the most splendid of the group, and that which alone would justify their collective name of Selworts, or Selanthi, was only discovered in the year 1818, by Dr. Arnold, the naturalist, who accompanied Sir Stamford Raffles in one of his journeys into the interior of Sumatra: it is said that the natives call it *Ambun Ambun*, or *Krûbût*, i. e. *the great flower;* and it is, in truth, a vegetable Titan. The specimen first found by the lamented Arnold, (in remembrance of whom, and likewise of Sir Stamford Raffles, it has been called the *Rafflesia Arnoldi*,) measured *a full yard across;* the petals being twelve inches long and a foot apart from each other: the nectary, adds the Doctor, (in an unfinished letter to a friend, which was published posthumously,) would, in the opinion of us all, hold *twelve pints;* and the weight of this prodigy we calculated to be fifteen pounds.

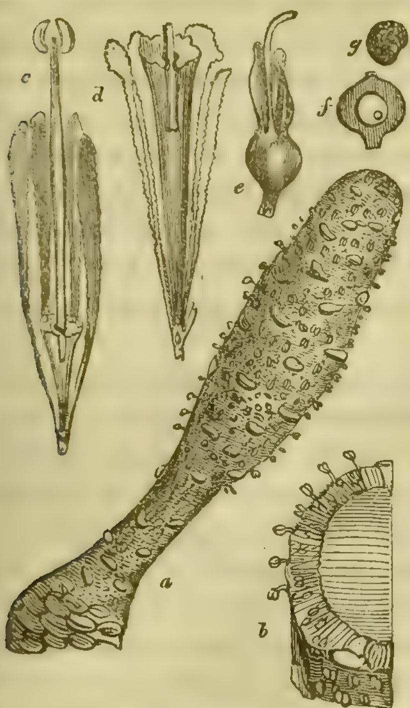


(112.) Several other allies have since been found, some of which are figured by Blume, in his "Flora Javæ," but none have been as yet discovered that equal Arnold's flower in bulk.

(113.) All these curious plants agree in several particulars. In the first place, they have no proper roots of their own, and they derive their nourishment from the vegetables on which they grow; in the second, they have no stems, the flowers being sessile on the vines that bear them; thirdly, they are destitute of leaves, the blossoms being covered only by scales, which are purplish or brownish, and resemble the chaffy scales of other parasitic plants; for, as they derive their nourishment already prepared by the leaves of another vegetable, they do not require any foliage of their own: so that here we have plants consisting of flower only, neither root, stem, nor leaves, being truly present; and what seems still more curious is, that, although the largest and most magnificent flowers in the world, they have very little in common with other flowering plants. They have no proper seeds, but are multiplied by spores, similar to the spawn of mushrooms; to which, indeed, their general form bears no slight resemblance. The petals are of a mushroom-like substance, and smell like *tainted beef;* and in them flies deposit their eggs, as they often do in fungi. Again, they contain no tubular or spiral vessels, like most other flowering plants, but consist of cells alone, like the mushroom tribes; they also spring from beneath the bark of the Cissus, which becomes gradually enlarged by their growth, somewhat resembling that false covering which several of the fungi have that grow on living plants; raising the outer surface into tumours, and bursting it as they become

more fully developed; such as the blight and blasts of corn, and so forth. Thus these stupendous flowers, which are from six to nine feet in circumference, show a likeness to the most lowly of the mushroom tribes, many of which are so minute as scarcely to be visible to the naked eye.

(114.) The *Helosis*, the *Balanophora*, and the *Cynomorium*, or Fungus Melitensis, formerly guarded with such jealous care by the knights of Malta, and sent by the grand master to all the friendly



(*a*) Entire plant, reduced, and separated from its parasitical connexions.

(*b*) Transverse section of the spadix, or club-shaped axis, to show the crowded arrangement of the flowers.

(*c*) Staminiferous flower, detached.

(*d*) Ditto, later stage.

(*e*) Pistilliferous flower, shewing the enlarged inferior ovary.

(*f*) Section of fruit, shewing the globular albumen and embryo.

(*g*) Seed, with endorhizous embryo.

[From Richard's monograph in *Mem. Mus.*]

Cynomorium coccineum *olim* Fungus melitensis, or Mushroom of Malta.

sovereigns and potentates of Christendom, as one of the most precious offerings he could make, may be cited as further examples of this extraordinary group. So fungus-like are some of these vegetable paradoxes, that they have been commonly considered such. The names imposed upon the former not improbably allude to some supposed retrogression towards the clavate forms of many Sphæriæ, or the club-shaped growths of the Clavariæ; and the latter especially has long been known as the *Maltese champignon*, or *mushroom of Malta;* and, were it not for the development of stamens and pistils, the propriety of changing the name, and disturbing the old arrangement, might admit of being questioned.

As it is, the characters will fully justify their segregation as a class from other flowering plants; the higher grades of which are by them allied to the lower flowerless and leafless sections.

(115.) Thus having traced the gradual evolution of the vegetable organismus, from the simplest of the flags and fungi, through some few of the numerous stages of development which characterize the several orders and regions of the vegetable reign, to the plants included in this final class, the present conspective sketch is closed; for they here descend towards those with which the series was begun; and, connecting the extremes of an extended scale, declare that however, for convenience, art may reduce the productions of nature to isolated groups, and divide them into separate sections, still that they are divisible by art alone; and, although relatively distinguishable, they are not absolutely separable; for, however diverse the distant members may appear, they are all intimately connected and essential to each other, and form, in their respective subordinations, but integral parts of one majestic and harmonious whole.

(116.) This bird's-eye view of the vegetable kingdom, thus condensed into the form of an introduction, has, of necessity, been very brief and general. It was, indeed, intended to be nothing more than an index or an outline, a preliminary sketch or diagram of the several chief departments that are recognized or easily recognizable by all. But slight as this prefatory notice of the several classes purposely has been, here our conspective view must cease: the plan forbids more copious demonstrations; nor are they needed, as hereafter each class must be examined separately and in detail. Still it is hoped that the end proposed has been attained; viz. the proof, by actual illustrations, of what "a varied thing" a vegetable is.

OUTLINES OF ALGOLOGIA.

(117.) Chaos, the refuge of ignorance, has ever been a favorite speculative beginning, whence men, in their presumption, have set out to create the world, and whence they would derive the origin of all things in it. But to nature, confusion is unknown; all her works are done designedly and in order. It is human weakness that alone confounds well-regulated phenomena, and forms a seeming rude and undigested mass, in which method still prevails, although unseen; the supposed disorder being order not rightly understood.

(118.) To such a chaos, as to their beginning, vegetables once were traced; and from such a source the simplest were supposed to spring: hence they were named Chaodinæ, or *Chaotic* plants. But since knowledge has enlightened the region which ignorance formerly obscured, it has been shewn that their origin and growth were never lawless, though the laws of their production were long unnoted, and may remain longer still, in part, unknown.

(119.) One form is even now, by some, retained in this so-called chaos of the vegetable world. The others, and they were many, have, as their histories were learned, been gradually reduced to their proper stations; and this, which seems still obscure, is chiefly so, from its resemblance to the early states of several kindred flags, of which it may be probably only an abortion. Hence the propriety of its chaotic tenure is more than questionable; for, if a distinct and independent plant, it should commence the Nostoc series, [vide § 149]: if merely a rudiment or abortion, as soon as its connexions can be traced, its natural arrangement will be ensured.

(120.) With this doubtful substance, which is a slime-like jelly, abundant in various places, especially in damp situations, and more particularly in stagnant water, the ascending synthesis begins; for in it, or in a similar nidus, the Algæ in their earliest states are found. It has therefore been called the *matrix*, or mother of the flags; technically, *Phycomater*.

(121.) This phycomater, or primitive nidus, is more or less evident or obscure, and more or less permanent or transitory, in the various groups of Algæ, to which it therefore becomes an index, affording, under the name of *thallus*, some of their most obvious distinctive signs.

(122.) Those plants in which it is evanescent, or obscure, are in appearance the simplest in their structure, although it is probable, as will immediately be shewn, that the humblest protophytes are those in which it the most abounds.

CONFERVALES.

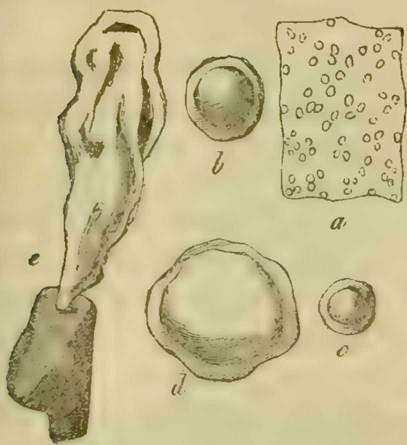
(123.) The simplest forms of decided vegetables known, and some of the simplest which it is conceivable can exist, are cells and threads of various shapes and sizes, which abound in stagnant pools: they have been called by Turpin, from their round and

A. Protospheria simplex, simple spherulet, natural size. B. Ditto, magnified. C. Protonema simplex, simple thread-reet.

elongated forms, *Protospheriæ* and *Protonemata*, respectively. Others, a little more advanced in structure, he has denominated Globulines, [vide § 28.]

(124.) Threads and vesicles, similar to those which constitute the Protospheriæ, Protonemata, and Globuliniæ, in which plants they are apparently free, are often found suspended in, or springing from, a slime-like nidus, analogous to the Phycomater already named, and are then, in common with the slimy films or masses, known vulgarly on land as "flowers of heaven," "dead Will-o'-the-wisps," or "fallen stars;" and when noticed in water, they are frequently mistaken for, and denominated, *scums*. *Palmella cruenta* or *gory dew*, [§ 44, 132,] and *Nostoc cæruleum*, or *flower of heaven*, [§ 42, 149,] are examples already described. Palmella

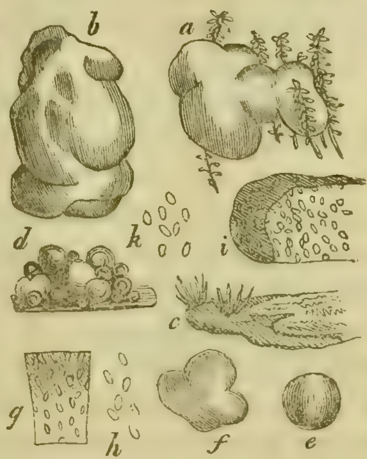
hyalina, and P. protuberans and botryoides, are further illustrations; the former being an aquatic, the two latter terrestrial species.



Palmella hyalina.

(*a*) Part of frond in which the granules are seen often assuming a quaternary arrangement.
(*b, c, d*) Plants of the ordinary shapes. (*e*) Plant lengthened out by growing in a rather rapid stream.

Grev. Crypt Fl. plate ccxliii. &c.



(*a*) Palmella protuberans. (*b*) Mass, natural size, beginning to become shapeless. (*i*) A section.
(*k*) Granules magnified. (*c*) Palmella botryoides. (*d*) A group of plants magnified. (*e, f*) Plants separated. (*g*) A section of the thallus. (*h*) Granules.

(125.) These fallen-stars and water-slime plants, though generally containing threads or cells, are often found without any perceptible filaments or vesicles within them. In this apparently amorphous state, these vegetable slimes have been by some considered as "a provisional creation waiting to be organized;" or as a chaotic mass, whence forms the most regular and beautiful should spring.

(126.) With more probability, however, these gelatinous productions may be esteemed, as already hinted, the rudimental states of the cells and threads which, under favorable circumstances, are subsequently developed within them: or they may consist both of the embryos and exuviæ of vesicles and filaments, which in such early stages are individually so minute, that their separate outlines are invisible; and many of which remaining abortive, or becoming but partially developed, constitute the slimy masses; while others, being fully evolved, form the simple vesicular and filamentous plants alluded to.

(127.) This slime, in which the vesicles are situated, and which is often more evident than the vesicles themselves, has received the name of *thallus*, from *thallo* (θαλλω), to germinate or sprout; as in it the filaments and vesicles are often formed, and from it they usually spring.

(128.) This slime-like matter, when permanently destitute of visible threads and cells, even if an abortive phycomater, cannot be proved to be the nidus of any especial flag. Hence, for convenience, it has been generally considered as an example of the lowest grade of vegetable organization, and treated of as a plant distinct from those of which it is probably only the abortive, incipient, or exuvial state. If such a view, which in the present state of knowledge it is expedient to take, should hereafter prove to be correct, this slime-like matter will rightly claim to be ranked as one of the most simple vegetables in existence. Until this obscurity is removed, or its connexions traced to any acknowledged species, it may be called (Protoglia ambigua) the doubtful slime-plant: a name proposed as being in consonance with *Proto*-spheriæ, and Proto-nemata, already given to the filaments and vesicles, which, with these jelly-like productions, may be esteemed the primitiæ of the vegetable world.

(129.) When these slimy films divide, or when the cells which they contain [see § 28, 139, &c.] are separated, each part becomes an entire, distinct, and independent plant; which grows, and again divides. The dismembered joints are called offsets, (*frustula* or gonidia,) being as it were slips or colonizing fragments, given off from the slimy mass, or parent cell, and serving to propagate the species.

(130.) The frustules or cellules of these plants, or the separated cells, which constitute entire and independent vegetables, contain small grains of various colours floating in the fluid, which distends their coats: collectively, this matter is denominated *Endochrome*,* and each grain is termed a *granule*.

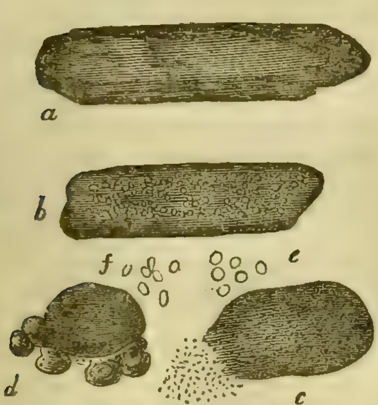
(131.) When the vesicles contain still smaller vesicles within them, the internal cells are denominated *spores*, from speiro (σπείρω), to sow, as from them fresh plants arise; and the larger cells, in which they are contained, are called *sporidia*, or spore cells: the spores in these humble tribes being equivalent to buds,

* From Ἔνδον, *Endon*, inner or internal, and χρῶμα, *chroma*, colour.

or seeds, and the sporidia to seed-vessels; although, from the simplicity of their structure, they have received another name.

(132.) Turpin, who examined many of these plants minutely, named them *globulines*, from their generally rounded forms. They are some of the simplest of the series called *Lepra*, by the older writers; and allied to the *Proto-coccus* and *Palmella* of modern systems: one species of which is familiarly known as *gory dew*, (Palmella cruenta) [vide § 44, 133], and another as *red snow*, (Protococcus nivalis) [vide § 47].

(133.) These several instances will serve to shew the varied manner of their growth and increase; for the Protococcus consists of numerous coloured vesicles or sporidia, seated on a slimy thallus, [vide § 47,] while in the Palmella cruenta, the thallus encloses the



Palmella cruenta. *Grev.* 205.

(*a, b*) Plants, natural size and magnified.

(*c*) Fertile portion of the thallus.

(*d*) Portion of the jelly-like thallus.

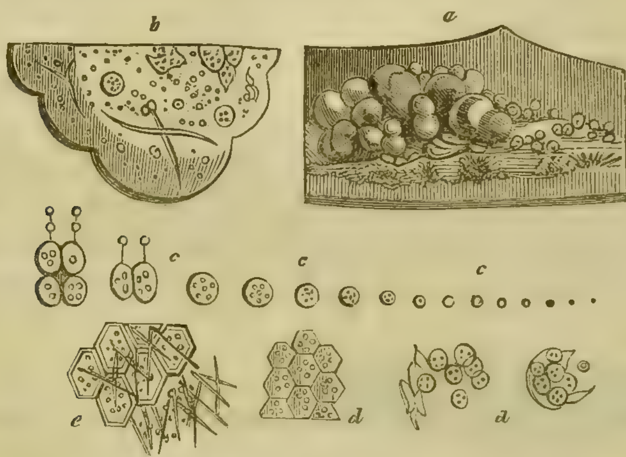
(*e, f*) Granules magnified.

globules, and in Protosphæria the cellules are free, and the thallus latent or obscure [vide § 123.]

(133.) Within the first-formed vesicles of the snow plants, as they increase in size, other still smaller vesicles are seen to form, by the growth of which they become so far distended, that the maternal films are ruptured, and a numerous progeny poured forth, in every one of which, at, or even before, the time of birth, the embryos of future generations may be seen. These, in succession, become similarly developed, and speedily run through their several stages of existence: so that, although small plants, they increase with most astonishing rapidity.

(134.) In the Globuliniæ, [vide § 28,] the mode of propagation is the same: but in them the phycomater is evanescent, or the thallus not evolved; and in a beautiful ally, named, in honour of

the celebrated Bichat, the *Bichatia*, and, from its vesiculine structure, *vesiculinosa*, the slimy thallus is in like manner abortive, so that each vesicle, immediately on its exit from the parent cell, is esteemed an entire and perfect plant; while in the Protococcus,



Bichatia vesiculinosa (natural size.)

(*a*) Masses on glass, in several states of growth and decay.
(*b*) A drop of water, on the field of a microscope, containing Bichatia and Protonema.
(*c*) Progressive increase in the size of the vesicles, union, &c.
(*d*) Parent vesicles, bursting and discharging the offspring.
(*d*) Hexagonal form assumed on compression.
(*e*) Figure of cellular texture of Mesembryanthemum barbatum, to shew similitude of cells and raphides.

or red snow, the thallus being more fully developed, and maintaining for a time a connexion between the several cells, each mass, like a tree, is considered as but a single though compound individual plant; the slimy thallus or receptacle being the bond of union, the basis of the social compact, each larger vesicle a *sporidium*, and each smaller cell a *sporule*.

(135.) The presence or absence of the slimy thallus is the chief distinctive character between the two first groups or sections of the vegetable world; for, in the one it is mostly abortive or obscure, in the other notorious and abundant. Illustrations of these two groups have now been given, and so simple are they both in structure, that it is difficult to say to which precedence should be yielded; for, although the threads and cells form each more simple plants when separated than when multitudes are held in union by the slimy thallus, still the entire development of the phycomater into cells, and its absence as a thallus, would seem to indicate a greater

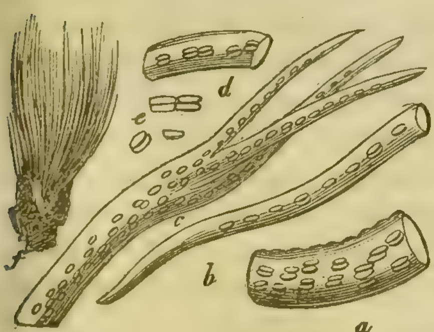
energy of life in the isolated Globulines than in their allies, Nostoc, Palmella and Protococcus, where much of it remains permanently abortive in the jelly state.

(136.) Those plants in which the thallus is absent or obscure are very fragile, and their parts easily separate from each other. Indeed, one genus has been called *Fragillaria*, from its extreme fragility, and another *Diatoma*, from the spontaneous division of its members that continually occurs. This fractional tendency is not peculiar to the two genera just named, but more or less prevails throughout the group; and hence, from *Fragillaria*, which is esteemed the normal genus, they have been collectively denominated FRAGILLINÆ, or *Fracture-worts*.

(137.) Those plants in which the thallus is predominant, or in which at least it is not very obscure, form another section, called collectively, from *Nostoc*, the botanical name of the Fallen star, the NOSTOCHINÆ, or jelly-worts. This section, as well as the foregoing, contains many curious vegetables, which, notwithstanding the labours of modern physiologists, are still much too little studied, and by far too little known. [Vide § 43, 44, 45, 46, and 47.]

(138.) A gradation may be traced from the *Nostoc*, in which the thallus is predominant, through many plants in which it becomes less and less conspicuous, to the collateral section, the *Fragillinæ*, in which it is absent, or at least comparatively obscure, and in which, when present, it separates into definite segments.

(139.) In the *Schizonema comöides* (*hair-like leather-thread*)



Schizönema comoides.

(*a, b, c, d*) Portions magnified.

(*e*) Granules.

(*f*) Tuft of plants, natural size.

Grev. Cryp. 358.

the vesicles are arranged in pairs within the slimy thallus; and in the *Schizonema quadripunctatum* (*four-celled leather-thread*), the vesicles are disposed in fours, but in (the *twinnule*) *Geminella in-*

Schizonema quadripunctatum.

(*a*) Natural size. (*b*) Filaments, separate and magnified. (*c*) Filaments, with granules. (*d*) Appearance of immature granules.

(*e*, *f*, *g*) Frustules formed by division of the thallus. (*h*) Granules, after being discharged from the tubular filamentous thallus.—*Grev.* 286.

terrupta the thallus, if present, is invisible; and its existence is only presumed from the circumstance of the cells being regularly arranged, and maintaining regular relative positions in each series; while the different series, floating about in the water, continually change their positions, in regard to each other. In the following figure, the dotted line indicates the supposed tract of the invisible thallus; the ciphers, the twin-cells of the geminella.

oo . . . oo . . . . oo . . . . oo . . . . oo

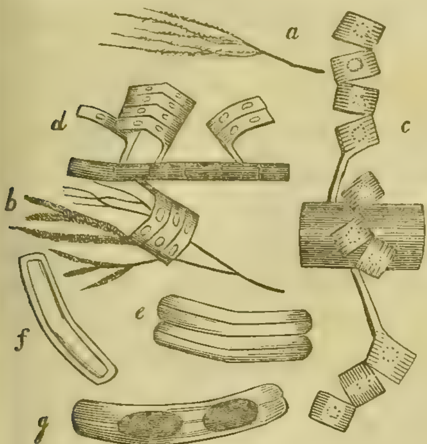
FRAGILLINÆ.

(140.) Globulinaceæ. *Protosphæria* (the spherulet), and *Protonema* (the threadlet), already described and figured, (vide § 123,) with *Globulinia* (vide § 28), form a subordinate group amongst the Fragillinæ, known by the constant separation of their cells, each of which, from an early state, forms a distinct and independent plant. In this type, which, from the normal genus *Globulinia*, is called Globulinaceæ, the phycomater is evanescent; and hence, the several cellules, having no common bond of union, separate at once into fragments, each of which is a distinct and independent plant. In Bichatia, the phycomater partially remains, and, by uniting for a time two or more cellules, shews the connexion between this and the following type.

(141.) The Globulines and their allies, Protosphæria, Protonema, &c., occur in various fluids, as in wine, beer, and many vegetable infusions. Of the two latter genera only a single species has been described, called, in either case, *simplex*. Of the genus Globulinia there are many species known, which, though nearly identical in

form, vary in their colours and their stations. Hence they have been named, either from their hues or habitats, *G. lactea*, *atra*, *sulphurea*, *cærulea*, *rubra*, *botryoides*, *vini*, *cerevisiæ*, &c.

(142.) Diatomaceæ, or *Fragillaceæ*. In the sea-froth plants (Achnanthes), and the different species of sea-cut thread (Schizo-



(*a*) Achnanthes unipunctata.

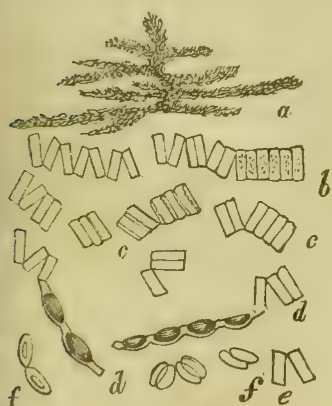
(*b*) A. brevipes, natural size.

(*c*) Portion of *a*, magnified.

(*d*) Portion of *b*, magnified.

(*e*, *f*, *g*) Joints, or frustula, separated.—*Grev.* 287 and 295.)

nema), the sea cleft-foam and fract-foam (Diatoma and Fragillaria),



Diatoma tenue.—*Grev.* 354.

(*a*) Natural size.

(*b*, *c*) Portions magnified, shewing their separation into frustules.

(*d*) Frustules of different forms.

(*e*, *f*) Frustules separated.

with their numerous allies, the thallus, though not wholly absent, is in general obscure, and hence, although the cells are for a time connected, they subsequently separate into fragments (Frustula), each portion becoming an independent plant, or the germ of an infant colony; which, as it increases in size, again divides, and multiplies by every division.

(143.) Tenacious of vitality as each *gonidium*, or frustulum, in each propagating section seems to be, yet so feeble are the powers of life with which these lower vegetables are endowed, that they

appear unable wholly to withstand the laws that govern lifeless matter, or to protect the materials they contain from common chemical affections: for, within each vesicle of several species, there are found one or more distinct and perfect crystals; probably derived from the salts dissolved in the fluids which the organic structures of the plants had enabled them to concentrate as well as to absorb. (Vide § 142.)

(144.) Until lately the genera included in the type *Diatomaceæ* formed but a single group, but, from the form of their frustula, Dr. Greville has arranged them in four subordinate associations or subtypes.

The first subtype *Cymbellidæ* (or Cymbelleæ) includes all those Diatomaceæ in which the frustules are elliptical; such as *Cymbella* (the boatlet), *Schizonema* (the cut-thread), and *Berkeleya*, a curious and very fragile flag, which has been named in honour of the Rev. Miles Berkley, a learned Algologist, who is now publishing his Gleanings of the British Algæ.

(145.) In the second subtype, *Styllaridæ* (or Styllariæ), which includes the normal genus *Styllaria*, and its allies, the frustules are flat and wedge-shaped.*

(146.) While in the third, *Fragillaridæ* (or Fragillarieæ†), they are plane, rectilinear, and often filamentous. *Fragillaria*, *Achnanthes*, *Diatoma*, and *Frustula*, are examples of this subtype.

(147.) Allied to the foregoing are certain plants in which the filaments are round or angular, not plane, and which have hence been formed into the subtype called, from *Desmidium*, the bond-weed, *Desmididæ* (or Desmidieæ).

(148.) Such are the subordinate groups into which Greville has distributed the type *Diatomaceæ*, or *Fragillaceæ*, and, as they are more definite and satisfactory than those of Fries, they are adopted here.‡

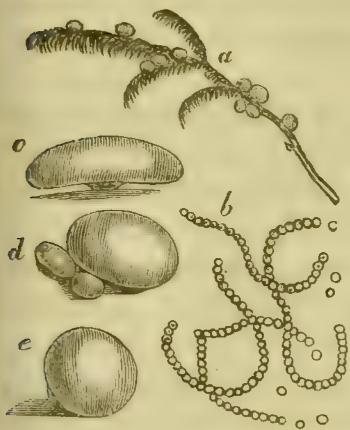
* The Styllariæ form part of Bory St. Vincent's Zoocarpes, [§ 29.]

† I could very much wish that words, like *Styllarieæ*, *Fragillarieæ*, &c., which it is utterly impossible to pronounce distinctly without putting a semicolon between each ultimate, penultimate, and antepenultimate syllable; *e.g. Styllari; e; æ*, *Fragillari; e; æ*, &c. &c., were no longer tolerated by botanists as the names of groups of plants. The above, I know, are formed according to established principle, but they are not the more euphonious on that account; and I trust that Dr. Greville will pardon me for venturing to offer *Styllaridæ*, *Fragillaridæ*, &c., as substitutes or synonymes.

‡ While these pages have been passing through the press, the first part of Dr.

NOSTOCHINÆ.

(149.) NOSTOCHACEÆ. *Nostoc*, (the fallen-star), Palmella (the



Nostoc cæruleum.

(*a*) Plant, natural size, on Hypnum aduncum.

(*b*) Filaments of cellules disarticulating.

(*c*, *d*, *e*) Plants separated, to shew their various forms.—*Grev. Crypt. Flor.* 131.

earth-dew, (vide § 124 and 132), and Protococcus (the red-snow, vide § 47), all of which have been described, form, with Hæmatococcus, and other allies, the type *Nostochaceæ*. Lightfoot states that one species of Palmella, the montana, is the *Mountain Dulse* of the Scotch: the Highlanders, he says, wash it and rub it between their hands in water, so as to make a paste, with which they purge their calves.

(150.) The *Hæmatococcus sanguineus*, or blood-stain, like the *Palmella cruenta*, or gory dew, gives to the rocks on which it grows the appearance of being stained with blood. Captain Carmichael found it "spreading over the roof of a dry cavern in a quartz rock, (Appin,) to the extent of several yards, in the form of a thick uneven efflorescence of a brick-red colour externally, but whitish within."

(151.) *Echinella*, the *hedgehog-wort*, so named from the bristly aspect it assumes, its corpuscules radiating like "quills upon the fretful porcupine," is a very curious plant, its species having (according to Captain Carmichael), the power of moving from place to place. This distinguished naturalist observes, that "these are animals, instead of plants, if the faculty of locomotion will entitle them to that rank." (*MS. quoted in Hooker's English Flora*, vol. v p. 398.)

Hooker's fifth volume of the "English Flora" has been published, and, as it contains the results of much labour in the departments here being described, I gladly avail myself of the opportunity which correcting the proofs affords of adding to the value of these Outlines, by inserting, as above, occasional extracts.

(152.) *Nostoc* being the best known genus, this type has been from it called the *Nostochaceæ;* of which the following differential characters are given by Greville: *thallus more or less globose, gelatinous or fleshy, including cellules that are either irregularly dispersed, or arranged in moniliform series.*

(153.) Rivulariaceæ. *Rivularia,* the rivulet-moss, so called because the species first known inhabited fresh water, (some of those since discovered are, however, marine,) and *Batrachospermum,* the *frog-spawn-wort,* (the appearance of which is well suggested by its name,) are the normal genera of two subtypes, the Rivularidæ and Batrachospermidæ, which, together, form the type now under consideration.

(154.) The *Rivulariaceæ* are gelatinous or fleshy plants, globose or filiform. In the *Rivularidæ* the thallus is always more or less globose, and the filaments continuous and annulated within. In the *Batrachospermidæ* the plants are often filiform, and the filaments articulated and branched.

(155.) Collectively, the two types *Nostochaceæ* and *Rivulariaceæ* form the section *Nostochinæ.* Their definite, persistent, jelly-like thallus, not separating into fragments, but rupturing and discharging its contents, appears to be the most certain diagnostic sign associating these two types, and distinguishing them from the sections by which they are followed and preceded.

(156.) Insignificant as these protophytes may appear, they will be found, on examination, to perform several very important functions in the general economy of nature. Consisting as they do, almost entirely, of slime, or a slime-like jelly, they afford a large supply of most nutritious food for the minute animalculæ that abound in the same situations with themselves; which, in their turn, become the sustenance of higher tribes; and these, again, together with several species of Conferva, are fed upon by fish.

Furthermore, these plants are most serviceable in purifying water, by associating and assimilating for their own support much of that foul matter with which all ponds and streams are continually becoming polluted, and which is so deleterious to animal life. Their uses as food and as refiners are, however, far less important than their function of elaborating oxygen, which the experiments of Priestley and his followers shew that the Confervales do, in a very remarkable degree; thus rendering the water respirable by fish and other gill-breathing animals, whose constant consumption of

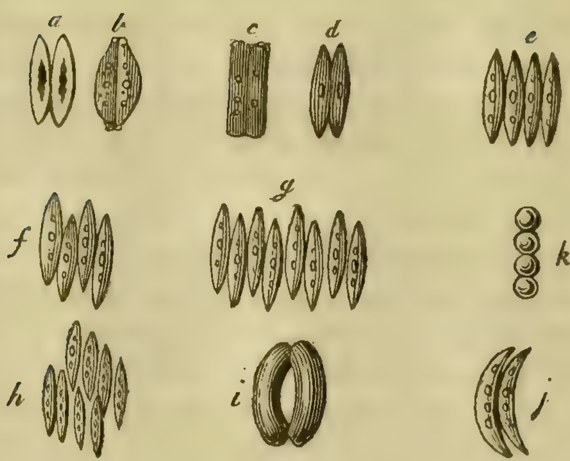
its air requires as constant a renovation. It is indeed a notorious fact, that fish are never so healthy in reservoirs destitute of aquatic plants, as in ponds and streams wherein they abound. This, in part, is owing to the oxygen which all these flags set free: but the jelly-worts have another use; for it is by their viscidity that the water is enabled to include and retain very considerable proportions of common atmospheric air; much larger quantities than it could, were it perfectly pure, and destitute of these living jellies. The air thus imprisoned, like the air contained in gelatinous beverages, such as many wines and beers, is far more abundant than persons in general suppose: its presence, however, becomes at once evident when rarefied by the sunbeams, and it is always demonstrable by artificial heat, or by means of a pneumatic apparatus.

(157.) But, interesting as the perusal of every page in the book of Nature is, the minute examination of these simple plants should not be regarded as a study affecting *their* history alone; for, as parts similar to these primitive formations occur combined in the compound textures of more elaborate vegetables, much light is occasionally thrown on the construction of the higher, by an exact knowledge of the structure of the lower grades.

(158.) Hence, as the one appears chiefly to consist of permuted repetitions of the forms of the other, the lower may, in some measure, be esteemed the uncombined anatomical elements of the higher ones offered to examination in a distinct and isolated state.

(159.) The forms of the vesicles of which these cellular plants consist have been already shewn to be very various, almost as diverse as are the forms of the cellules in the cellular textures of the most elaborate vegetables known. In the *Diatomaceæ*, the variety is greater than in either the preceding or succeeding types; for among them are found not only lengthened threads, with spheres and spheroids, elliptic, cuneate, and ovate frustules, but likewise rhombs and rhomboids, plane, and cubic, with parallelograms, &c., in almost every imaginable diversity. For example, take Tessarthonia, and Anthachne, Bacillaria, Navicula, &c., in the following figures, as well as Achnanthes, Diatoma, Schizonema, and others, previously given as illustrations. [§ 160.]

(160.) Many of these plants, it is seen, consist, in every joint, of similar and simple saccules, as in Tessarthonia and Achnanthes, (of Turpin, not Achnanthes of Greville, and hence it had better



(*a*) Navicula conjugata, Turp. (Vibrio Mull.) (*b*) N. geminata. (*c*) Bacillaria conjugata, (Anim-vegetaux of Turpin; Zoocarpes of Bory St. Vincent.) (*d*) Achnanthes bijuga. (*e*) A. quadrijuga. (*f*) A. quadrialterna. (*g*) A. octallerna. (*h*) A. obliqua. (*i*) A. stomatomorpha. (*j*) A. bilunulata. (*k*) Tessarthonia moniliforme.

be called *Anthachne;*) while others, and sometimes even different species of the same genus, have appendages attached, as in Anthachne bicaudata, quadricaudata, &c., which almost resemble a chain of Q℧Q℧Q℧Q℧, alternately inverted.

(161.) In the *sea-froth-plant* (*Achnanthes* of Greville), the flattened joints are supported on processes which seem to be formed by one or more cells extended lengthwise, while the breadth is undeveloped, (§ 142.) In one species, these processes are of considerable length, while in another they remain but short; which characters distinguish the *long-legged* from the *short-legged* sea-froth-plants, (*Achnanthes longipes* from *Achnanthes brevipes.*) In the Anthachne, the *sea-froth-flower*, the appendages, when present, do not serve as points of attachment for the plants, and hence they have more the appearance of tails; and from this their specific names, *two-tailed* and *four-tailed*, have been derived.

(162.) In other plants this change of form, from the spheroidal to the linear, may be traced through almost every gradation. From the *Tessarthonia* [§ 160, *k*], and *Anthachne* [§ 160, *d*, *e*, *f*, *g*, *h*, *i*, *j*], through the *Bacillaria* [§ 160, *c*], the *Navicula* [§ 160, *a*, *b*], &c., to the simple threads of the Protonemata of Turpin; (not the Protonemata of other authors, which are much more complex plants,) [vide § 123.]

(163.) Instances in which these filamentary productions are intermingled with undegenerate cells of the ordinary shapes, serving to connect them with each other, are found in the allied section, the *Nostochinæ*, especially in those plants which have hence been named *Chætophora*, the bristle-bearer, *Corynephora*, the club-bearer, *Myrionema*, the many-thread, and others. And observations would seem to favor the belief, that this admixture of cells and threads in the gelatinous thalli of many *Nostochaceæ*, depends upon the varied predominance of two opposite modes of development; and that, while some cellules retain their spheroidal or sub-spheroidal forms, others are developed longitudinally, or, as it were, wholly in appendages, the intermediate cavity degenerating, or becoming at length entirely obliterated, and then constituting a fibre.

(164.) Hence these simple plants shew the influence of the two powers or principles which regulate the varied forms of vegetable growth. For, the cellules which are globular in Protococcus [§ 47], Globulinia [§ 28], Protospheria [§ 123], and Bichatia [§ 134], may be considered as extended into lines in Protonema [§ 123], or flattened into disks in Diatoma; extremes where, on the one hand, little but axis, and on the other, little but circumference, remains; and towards which the lengthened ellipses of Anthachne [§ 159], and the oblate spheroids of Heterocarpella, are on either side approximations.

(165.) The vesicles thus consituting these simple plants are associated in very various numbers. Often the cells collected or united are so numerous as to defy computation; but in many they are definite, and in these there is a remarkable tendency apparent to the junction of the cells in pairs, or in some multiple of two. Take, for example, the *Anthachne* bijuga, quadrijuga, quadrialterna, octalterna, &c. [§ 159], as well as the *Tessarthonia* [§ 159, *k*], the *Navicula*, conjugata, and decimata [§ 159, *a*, *b*], the *Bacillaria* [§ 159, *c*], and others already referred to; as well as many more, which might be given in illustration, would not these suffice.

(166.) Thus the theory of definite proportions, so important to the chemist, is found not to be confined to the productions of the inorganic world; it is a doctrine which teaches much to the student of nature in every department, who hence will learn that nothing has been made, without a due regard to number, weight, and measure.

(167.) These plants afford the earliest instances in which this numerical progression can be shewn; and although various exceptions may occur, subsequent examples will prove, much more fully than these can do, the extent and value of the law. Two is the element among these simple plants; but other numbers, especially three and five, will form elements in other series.

(168.) These lower vegetables, which consist of slime alone, or of threads and cells containing sometimes smaller cellules, occasionally connected by films of slime-like matter, are often the dwellings and the food of many of the minute animalculæ to which a spontaneous birth has been most gratuitously imputed; which have been supposed to spring unbidden into life, and by some to be changed into animals from plants.

(169.) Extraordinary details of these apparent changes are on record. One naturalist declares that he has seen animals take root; and another, that plants, and even minute parts of plants, or small fragments of vegetable structure, as of the grains of wheat or barley, or the berries of yew, when separated and diffused through water, reassume each an independent animality, which had only been suspended whilst they formed parts of larger plants: and that, after having for a time enjoyed their animal existence, they become associated into lines which constitute *confervæ*, or attach themselves to the roots, or other parts of growing vegetables; whose growth indeed depends, according to this theory, upon the attachment of such monads in myriads to the extremities of their roots and other parts.

(170.) The phenomena which have seemed to favor this belief are, first, the appearance of animalculæ in vegetable infusions; and secondly, the motions which the particles of organic bodies are seen to perform after their dissolution, or separation from each other: which latter circumstance has led some very able naturalists to assert, that all the larger animals and plants are built up of smaller ones, called monads; and that the decease of a man or a tree, is not so much a death, as a dissolution; for that, when the bonds which held myriads of monads together to form a single individual are loosened or dissolved, that then they all again resume their independent vitality, the destruction of one giving freedom to many.

(171.) But locomotion, by which the animality of certain minute corpuscules was once presumed to be established, has

lately been proved to be no evidence of vitality at all. Dutrochet has demonstrated that locomotion may, and often does, depend upon external physical causes, and not upon any individual volition. He observed, that fragments of moss will move about, as if spontaneously, in the water in which they float, [vide § 36;] and subsequent experiments have shewn that bags of bladder, or other permeable membrane, for a limited period, under certain circumstances, do the same. And furthermore, Dr. Brown has discovered the extraordinary fact, that the smallest fragments into which matter, whether organic or inorganic, can be divided, are all, when suspended in a fluid, constantly in motion, [vide § 38.]

(172.) With regard to the apparently fortuitous generation of animalculæ, and their supposed transformations into plants, it should be observed that, from the minuteness of the objects to be examined, from many floating about in water unattached to any soil, and from the extreme simplicity of their structure, it is often very difficult, and sometimes impossible, to determine with precision what are the vesicular ova of certain animals, and what the vesicular sporules of certain plants; and even to distinguish the simpler animalculæ and microscopic vegetables from each other. This is owing partly to the similarity in the forms of some; but more to the ova of the former being deposited and hatched in the vesicles or amongst the slime of the latter, a condition by which the whole mass becomes replete with animal life, and the slimy thallus enlarged at the expense of the cellules, that often, in such cases, remain abortive: just as, in the formation of galls by the puncture of insects, a tumor is produced by the excessive development of the pulpy structure, which involves the abortion of the parts that would have been otherwise naturally produced.

(173.) These are the phenomena which have probably countenanced the theory of the metamorphosis of plants into animals, and of animals into plants; a change, of which it is believed there has been hitherto no positive evidence adduced. That there are beings which, during a part of their existence may be attached and germinate, and subsequently become detached and swim about from place to place, has already been shewn with respect to the zoocarpes, and other examples will be adduced hereafter. Yet such changes are only the common laws of their existence, just as the metamorphoses of insects are of theirs. But the idea that an

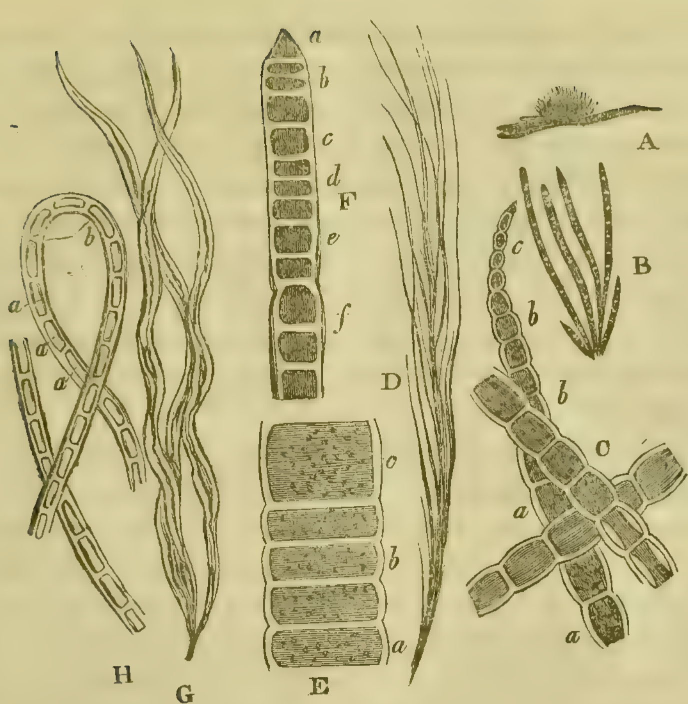
animal, even the favorite *monas termo*, can be produced by the dissolution of the simple vesicular structure of a plant, is a position not only without proof, but no longer tenable as an hypothesis, since Ehrenberg has shewn the elaborate organization which exists even in these microcosms, [vide § 27.]

CONFERVINÆ.

(174.) In the two preceding sections of this order, the Nostochinæ and Fragillinæ, the thallus is very variably produced. In the one, although definite, it is often little else than an amorphous mass of slime, in which numerous threads and cellules are contained; and in the other it is so obscure, or so far abortive, that the cells readily break away in fragments from each other. In this third, or succeeding series, it assumes another form; for the slimy matter from which, in *Schizonema* [§ 139], the cellules are discharged, and the existence of which in Geminella [§ 139] is wholly hypothetical, becomes, in the CONFERVINÆ, more and more membranaceous in its structure, or is replaced by a membrane in which there is no trace of organization, but which confines their vesicles, and determines, in many instances, their shape, as if they had been put into a mould; although, from its transparency and thinness, its presence is often overlooked.

(175.) If the contained vesicles are relatively few in number, they often remain spheroidal, as in the necklace-like frog-spawn-wort, *Batrachospermum moniliforme;* but, in the Confervinæ, the membrane investing the series becomes blended and lost to vision, by its joining with the walls of the various cells. In others, where the tubular thallus is comparatively small in its diameter, the cellules elongate, and from round become elliptic, &c., and at length the ends are flattened against each other, as illustrated in the following examples:

(A) Conferva curta, natural size. (B) A portion magnified. (C) Filaments still further magnified. (*a a*, *b b*, *c*) cells varying in shape in the same filament. (D) Conferva ærea. (E, F) Portions of filament magnified, to shew the variations in the form of the cells *a*, *b*, *c*, and *a*, *b*, *c*, *d*, *e*, *f*. (G) Conferva rivularis. (H) Threads magnified.



(176.) The vesicles thus connected, and more or less condensed, according to their number and the tubular diameter of the thallus, form at their various junctions apparent joints, which have been called *articulations;* but these articulations of the cells being invested by a continuous external membrane, are very different from the easily separable articulations of the Diatomaceæ, which are rather disarticulations than truly joints; and hence, although some of these Confervaceæ, as the water-net, Hydrodictyon, do occasionally propagate by the disintegration of their members, it is by no means common for this series of plants to separate into fragments spontaneously: they more frequently propagate by a rupture of the cells, discharging the sporuliferous endochrome, which the respective joints contain.

(177.) Oscillaceæ. The Quick Mosses, or *Quiver-worts*, so called from the vibratory movements or oscillations of their gelatinous fronds, whence indeed is derived their technical synonyme *Oscillaceæ*, form the first type of the section Confervinæ. There are some of them aerial and some aquatic plants; they abound in damp shady situations, in the sea, in ponds, ditches, streams, and even in thermal springs, such as those of Bath, and are of much use in fixing loose sand, and aiding in the deposition of mud. They

are as it were the strainers and refiners of nature; for, sometimes rising and floating on the surface, and then sinking through the water to the bottom, they involve, in their filamentous and gelatinous structures, much of the floating refuse matter which they and their allies have been unable to digest as food. Their action may be likened to that of mucilage or isinglass, put by brewers in their vats to refine the beer. And it is by these, and similar plants, that a great deal of mud is not only precipitated from water, but restrained at the bottom of streams, so that rivulets run with crystal clearness over successive strata of offal, which are thus curiously kept undisturbed.

(178.) *Oscillatoria*, *Lyngbya*, *Rosaria*, *Calothrix*, and some other Confervinæ, found either "in fresh water, the sea, or on damp ground, have been associated to form the type Oscillaceæ, of which the first named is the normal genus. According to Mr. Hervey, whose definition is the most satisfactory yet published, they are chiefly characterized by having their "thalli green or brown, rarely purple, continuous, tubular, seldom branched, though often agglutinated together so as to appear branched; fructification, an internal mass divided by transverse septa, finally separating into roundish or lenticular sporidia."—*Hooker.*

(179.) Perhaps the most familiar example of this group is the *Lyngbya muralis*, and, from its being the most common, it is, probably, likewise the most important. This plant, says Smith, forms in the wet months of winter a verdant tapestry on damp walls and stones, in confined areas and dark subterranean buildings, in which the inhabitants of crowded cities gasp for air, the effects of which on the atmosphere, by rendering it something more respirable, must be as beneficial as those observed by Priestley, to be produced by analogous species on corrupted water.—*Eng. Flor.*

(180.) The natural history of the oscillatoriæ is too interesting to be passed wholly without notice. They are so rapid in their growth and increase, that, as Captain Carmichael says, if from a stratum which on moist ground may occur of indefinite extent three feet and upwards across, a small portion be taken not more than a line in diameter and placed on a watch glass filled with water, the whole area of the glass will be overspread with filaments in the course of the night.

(181.) From the unpublished MSS. of this accomplished naturalist, Mr. Harvey makes the following extract, which is so

curious that I prefer transcribing it complete, to offering any abridgment.

"I have been induced to bestow considerable attention on such of the species as fell under my notice, on account of the singular motion remarked in the filaments by various naturalists; and I do confess, that the result is something like conviction that they belong rather to the animal than to the vegetable kingdom. This motion or oscillation has been attributed to various causes,—to the rapidity of growth, to the action of light, or to the agitation of the water in which the specimens were immersed for inspection; but none of these affords a satisfactory explanation: the last may be put to the proof by a very simple contrivance. Let a small portion of the stratum be placed in a watch-glass nearly filled with water, and covered with a circular film of talc, so that its edge may touch the glass; the water will be rendered as fixed as if it was a piece of ice. The glass may now be placed under the microscope, and the oscillation of the filaments viewed without any risk of disturbance from the agitation of the water. By following this course, it will be speedily perceived that the motion in question is entirely independent of that cause.

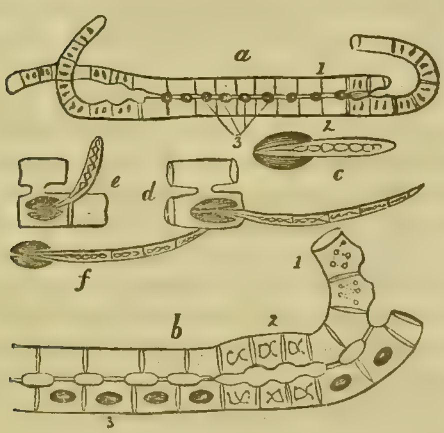
"The action of light, as a cause of motion, cannot be directly disproved, because we cannot view our specimens in the dark; but indirectly there is nothing easier. If a watch-glass, charged as above, be laid aside for a night, it will be found that, by the next morning, not only a considerable radiation has taken place, but that multitudes of the filaments have entirely escaped from the stratum, both indicating motion independent of light. Rapidity of growth will shew itself in a prolongation of the filaments, but will not account for this oscillation to the right and left; and still less for their travelling, in the course of a few hours, to the distance of ten times their own length from the stratum. This last is a kind of motion, I believe, unexampled in the vegetable kingdom. There is another point in the history of the Oscillatoriæ which favors the opinion that they are animalculæ; it is the extremely limited term of their existence. The community (if I may so call it) lives for several months, but the individuals die off, and are succeeded by others with a rapidity [vide § 180,] to which there is no parallel among genuine plants."—*Algæ Appinenses.*

These facts are most curious, but they do not appear fully to warrant the conclusion the learned writer seems inclined to deduce of the animal nature of the Oscillatoriæ. These beings, which are "on the isthmus of a middle state," are certainly as much plants as the Echinellæ, already mentioned [151], and as the Vaucheria clavata, shortly to be described.

(182.) Confervaceæ. The *Zygnemata*, or yoke-threads, form the connecting link between the Oscillaceæ and the present type; and their history is not less remarkable than that of the Oscillatoriæ, just described; for these plants, which are hair-like filaments, float side by side, or cross each other at intervals, and then unite, in a most extraordinary manner, by shooting forth processes which grow to-

gether, and form channels, through which the grains of endochrome contained in the cells of the one can flow into the corresponding cellules of the other. Subsequently to this natural grafting, the filaments separate again, and the sporules which have been formed either in the intermediate channels or in the original cells, are dropped into the water, and, germinating, give rise to a fresh generation.

Vaucher included among his Conjugatæ numerous species, which have since been distributed into several genera; one being the Zygnema just described. The accompanying figure is the *Conjugata pectinata* of Vaucher, and the *Zygnema pectinatum* of Agardh; but a further analysis having been made by Bory St. Vincent, it is now called *Tyndaridea*, from Tyndaridæ, the common name of Castor and Pollux.



Tyndaridea pectinata (Zygnema pectinatum.)

(*a*) Two individual plants becoming engrafted naturally together.

1, 2. Pullulations from each, projecting to form the union.

3. The common spores or fruit.

(*b*) Zygnema deciminum.

1, 2. Endochrome in the form of a roman X.

3. Fruit, after the engrafting has taken place, collected as a globule in one of the filaments.*

(*c*) Spores germinating (free).

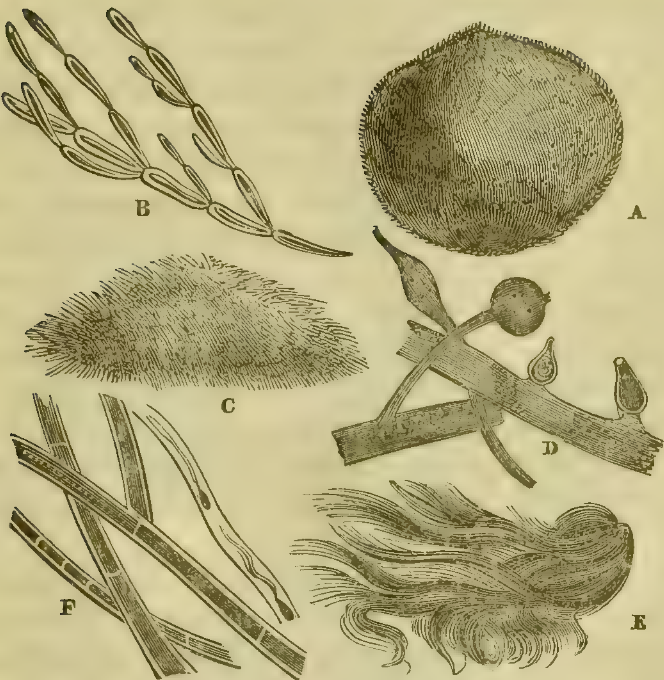
(*d*, *e*) Spores germinating within the cellules.

(*f*) Ditto, become free from decay of the cellule.

(183.) *Conferva*, though very much restricted since the time of Dillwyn, who included under that generic name almost all the types and sections of the present order Confervales, still remains an extensive genus, which may probably hereafter be again subdivided and further reduced. Conferva curta, ærea, and rivularis, or the dwarf, verdigris, and river crowsilks, [§ 175,] have already been figured; and C. ægagropila, vesicata, and crispata, may be taken as further illustrations of the genus.

(184.) *Conferva rivularis* [§ 175, A. B.] is very common in running streams; *C. curta* is a dwarf crowsilk, parasitic on Fuci;

* The draughtsman, in taking this figure from Vaucher, has combined the characters of two species; the endochrome in the curled end being in the form of a roman V repeated, which is distinctive of *Z. quininum*.



A. Conferva ægagropila, entire plant; natural size. B. Filaments separated, to shew their articulated cellular structure. C. Conferva vesicata; natural size. D. Filaments, with the vesicles magnified. E. Conferva crispata. F. Filaments magnified, shewing the variable length of the cells.

and *C. ærea* is also a marine species, common on the seashore: the long-tufted filaments of the latter assist in fixing the loose sand with which rocks are often covered.

(185.) *Conferva crispata*, (the curled crowsilk,) which is often thought to be only a variety of the common Conferva fracta, (broken crowsilk,) is found in vast abundance in ditches, both of salt and fresh water, forming immense strata, which, when they rise to the surface, cover the water, often for miles together, with a coat several inches in thickness. Between Bognor and Little Hampton I have seen it in the most astonishing profusion. These are some of the confervæ that contribute most to the clearing water, and filling up ponds and lakes. Economical peasants sometimes use these crowsilks as wadding for stuffing garments. They have also been woven into cloth; and Lightfoot says he has seen a kind of paper made in Edinburgh, from Conferva fracta.

(186.) *Conferva vesicata*, or the bladder-crowsilk, [§ 183, C. D.] is a curious though common species, found in stagnant water. It

is chiefly interesting from the tumid cells with which it abounds, prefiguring the conceptacles of the next type, and of the still higher Fuci. In it the endochrome is extremely evident, which, escaping in this group by an irregular rupture of the coats of the cells becomes the sporules whence fresh plants arise.

(187.) The *Conferva ægagropila*, the globe-crowsilk, or moor-ball, is a very extraordinary plant, [§ 183, A.B.] The numerous filaments of which it is composed grow closely impacted in a nearly spherical mass, so that a ball is formed, a good deal resembling those lumps of hair found occasionally in the stomachs of kids, calves, and horses. It is a wandering plant, unfixed to any soil, and entirely at the mercy of the waves. It is found in lakes, but it is rare. The only use to which it has been applied has been to wipe pens upon; for which purpose its soft porous texture fits it well.

(188.) *Hydrodictyon*, [vide Dillwyn, 97,] the water-net, which floats freely, spreading abroad its pentagonal meshes, which divide at their joints, in the same manner as the Fragillinæ, and Mougeottia, a genus separated from Zygnema, and named in honour of Mougeot, a German botanist of celebrity, might be given as further illustrations. This latter genus, and especially one species, the M. compressa, like the Hydrodictyon, shews an affinity to the lower tribes, by its fragility; and so various are the modes in which the articulations hang together, that Captain Carmichael appears to have been inclined to consider each joint a distinct individual plant, and a filament (to repeat his own words), to be "a chain of individuals cohering somewhat in the manner of the genus Salpa among the Mollusca."

(189.) CERAMIACEÆ. In the most numerous species of this section, the granules contained in the various joints are the sporules, which, when scattered by the rupture of the walls, serve to perpetuate the plants; but, in the more highly developed series, the Ceramiaceæ, instead of the sporules being indifferently situated in all the cells, some cells develop no fertile spores, while in others they are evolved most abundantly. These fertile cells are called *thecæ*, or spore cases; and they, after a time, like the other cells, burst, and discharge their contents.

(190.) When such a separation of function takes place, the term *frond* supersedes the use of *thallus;* and the contrary extremity of the frond to that which bears the thecæ often becomes less ex-

panded, and then is called a *stipes*. The end of the stipes is sometimes, though improperly, termed *a root*, but it is only the *base* of the frond: the true root is the result of a further development of the axis in union with an organ not yet explained. The base of the rootstake, or *rhizoma*, which has hitherto remained abortive, or only imperfectly evolved, in this shield-like expansion, is called the shield or holdfast, *scutum* vel *clavulus*.

A. Ectocarpus littoralis, parasitic on a fucus; natural size.
B. Filaments magnified. C. Portion with fruit.
D. Dasya coccinea; portion natural size. E. Portion magnified.
F. Fruit, *a*, discharging sporules, *b*, magnified.
G. Ceramium rubrum, (reduced, entire plant.)
H, I. Portions magnified; one with fruit.—*Dillwyn*, 31, 34, 36.)

(191.) The examples figured are *Ectocarpus littoralis*, (A, B, C,) a very common parasite, found on the larger Algæ; *Dasya coccinea*, (D, E, F,) the scarlet hair-wort, one of the most beautiful and abundant British illustrations of the type; *Ceramium rubrum*, (G, H, I,) the red vase-weed. *Ceramium ciliatum* (§ 3, fig. 2,) is a curious spiny species, and is remarkable for its rigidity and fragility, "the filaments breaking in the hand, as Mr. Sconce observes, as if the joints searated like those of an equisetum."—*Hooker, Eng. Fl.* 336.

(192.) Ectocarpus and Ceramium have both been considered normal genera, and this type has therefore been sometimes called

Ectocarpeæ, and sometimes *Ceramieæ;* but, as two subtypes have been formed bearing those names, *Ceramiaceæ* is the collective term by which the common group is designated here.

(193.) The Ceramiaceæ are well distinguished from all the other Confervales by their external fructification; and the two subtypes, which thus far agree, differ both in the colour of their fronds and the distribution of their conceptacles: the Ectocarpidæ (or Ectocarpeæ) being green or olive-brown, and bearing two forms of fruit, external conceptacles, and globules in swollen filaments, on the same plant; while the Ceramidæ (or Ceramieæ) are either red or purple, never green, rarely brown, and their joints beautifully transparent. They also bear their twofold fructification, not on the same, but on two different plants.

(194.) All these modifications of structure, which seem scarcely essential in such humble vegetables, prefigure, in an extraordinary way, the most elaborate organs of the more highly developed plants. They often anticipate as it were not only future internal textures, but also external forms; and sometimes the likeness is so strong as to have suggested an identity in name: *e. g.* take *Griffithsia equisetifolia*, *Calithamnion thyöides*, &c., which seem, from their aspects, to be the shadows which coming events have cast before.

(195.) The three types, Oscillaceæ, Confervaceæ, and Ceramiaceæ, although differing as to their fructification being external or internal, and in other particulars detailed in the histories of the respective groups, all agree in having articulated filaments, the cellules of which are contained within a fine membranaceous tube; the gelatinous thallus having become abortive. These common characters are therefore their associating as well as their differential signs.

(196.) In tracing the gradual series of developments through the simpler Algæ, a tendency to distinction in the uses of different parts becomes progressively more and more evident. In the loose and floating twinnules, in the cleft foam in the Nostocs, and in the red-snow, every portion of the surface appears equally able to absorb nourishment for the support and growth of the individual plant; and every part seems equally fertile, and able, by gonidia or sporules, to reproduce its kind; so that these two essential systems, that of reproduction and that of nutrition, without which the individuals could not exist, neither could the species be continued, are blended into one mass, and are either indistinguishable

from each other, or, when somewhat more advanced, still have one receptacle in common; but as the receptacle, or thallus, becomes more extended, a distinction takes place: a kind of stem is produced, as seen in an elementary state, even in the Achnanthes, and still more notoriously in the vase-worts (Ceramiaceæ.) This stem, in all these plants, is called a *stipes*, and is the organ or system of extension, in part distinct, and, according to the greater or less development of which, the organs of nutrition and reproduction are more or less separated from each other. As long as both the reproductive and nutritive systems are universally spread throughout this organ of extension, it is called a *thallus;* as soon as the reproductive sporules are collected into groups, it receives the name of *frons;* the groups of sporules being called *sori*, and the parts of the frons in which they are seated, *thecæ* or *conceptacles* (conceptacula); often also *capsules*, but this latter name, as will hereafter appear, is very objectionable.

(197.) From the systems of nutrition and reproduction being thus, in many individuals, blended, their presence has often escaped the notice of inaccurate observers, and their existence has even been denied. Hence likewise has arisen the supposition that certain plants are produced by chance, *i. e.* spring out of the earth, or from the dissolution of the substances on which they are found, without the intervention of other beings like themselves; *i. e.* without parental aid.

(198.) But the reproductive, as well as the nutritive system, is essentially present in some individuals of every species, at some period of their existence; and although in a few both have not been hitherto corporeally detected, their potential presence is declared by their effects; and the more scrupulous the investigations become that are made into these obscure recesses of nature, the less reason is there to doubt the generality of the dogma, "omne vivum ex ovo."

(199.) Many of the cases in which these reproductive organs are not demonstrable are, in all probability, the young or barren states of plants, which are fertile in other individuals of the same species, or in subsequent stages of their existence: *e. g.* mosses, and many other vegetables, are so greatly affected by locality, that in one situation they are constantly and universally fertile, and in another as constantly and universally barren; while some, which had long been considered sterile plants, stricter observations have shewn to be only the infant or abortive forms of well-known fertile vegeta-

bles. Of this the well-known Byssus velutina, which is now ascertained to be only the rudimental state of Polytrichum alöides, affords an apposite example.

(200.) With regard to the assumed spontaneous production of the Confervales, there has been a series of very satisfactory experiments placed on record by Fee, in his "Essai sur les Cryptogames des Ecorces officinales." This botanist found that, without the access of air, the common recipient and carrier of the seminules of such plants, none ever grew in water that was known to be perfectly pure, and that the periods and proportions of their development were in an inverse ratio with the purity of the water and the exclusion of the air. In distilled water contained in vessels hermetically sealed, or in open vessels kept in closed chambers, none were ever found to grow. One hundred and three days passed before any were detected in pure water placed in open vessels, and exposed to the atmosphere. In rain-water they were nearly double the time (one hundred and forty-seven days) in making their appearance, when in open vessels kept in closed chambers, to what they were in the same water exposed to the open air, (eighty-five days.) In river-water their coming was found to be more speedy than in rain, or in the water drawn from wells. Filtration also retarded their appearance; and in water from stagnant pools they were the most rapid and abundant in their growth, requiring only nine days, which is less than an eleventh part of the time necessary for their production in pure water, even when exposed in open vessels to the influence of the air.

(201.) But persons in general have been so long accustomed to regard fruits and elaborate seeds as the only organs of specific reproduction in plants, and roots as their only organs of nutrition, that the potential presence of the root, as diffused all over the absorbent surface, is often with difficulty admitted, notwithstanding it nourishes the plant, and is an efficient nutritive system; and the potential presence of the reproductive organs has hence likewise been denied, when plants are propagated by spores alone, or by the disarticulation of the various parts, although gonidia and sporules are as efficient as seeds in the office of reproduction.

(202.) In the succeeding series of the Algæ, or flags, these organs are still more distinct and evident than in the most distinct of the preceding sections; and those three systems, which, when inseparable from each other, are denominated the *systems* of nutrition, extension, and reproduction when separable, and chiefly

collected in especial parts or members, are then in general named the *organs* of nutrition, extension, and reproduction; the organ of extension being the part on which the nutritive and reproductive organs are seated, and to which they are attached.

(203.) All the plants which as yet have been given in illustration of the types Globulinaceæ (or scum-worts), Diatomaceæ (or cleft-reets), Nostochaceæ (or jelly-worts), Oscillaceæ (or quick-mosses), Confervaceæ (or crow-silks), and Ceramiaceæ (or vase-worts), however much they may differ as to the form, and number, and modes of union of the cells, the abundance or destitution of thallus, &c., still agree in their jointed structure, *i. e.* in the articulation of the vesicles. The series rises in several gradations, beginning with those in which each cell or joint is separated or disarticulated from all the rest; it then proceeds by those in which the vesicles, at one time connected, disarticulate spontaneously, to those in which, although the junction of the cells is evident through the transparent thallus, no spontaneous separation essentially takes place. Hence, collectively they have been named (Algæ articulatæ, or) jointed flags; (Arthrodieæ, or) joint-worts, joint-reets, &c.; and sometimes Confervæ, as formerly most of those which then were known were included in a single group, or genus, named Conferva, from the use which the ancients made of several species, as applications to confirm or strengthen the union of fractured bones. Therefore the Confervæ have a double claim to their appellation, *joint-worts;* firstly, from their former use, and, secondly, from their articulated structure.

(204.) *Confervæ* (or joint-worts), is hence perhaps the least exceptionable name that has been hitherto proposed; but, as some are characterised by disarticulations rather than by their articulations, and in others the articulations become confirmed in one continuous thread; and moreover, as the order includes the Nostocs as well as the Confervas (generally so esteemed), perhaps it would be advisable to blend the two names in one common appellation, or to call them collectively CONFERVALES, of which our provincial *reets* may be taken as the English synonyme.

(205.) This rustic name appears, like *reeds* and *reeks*, both given, like *reets*, to plants that grow in damp places or in running waters, to be derived from the same original root, ῥέω, to flow; and, notwithstanding the two latter have long been all but obsolete, they are in some provinces still retained, the one being applied to such minute plants as are terrestrial, with which the ground is

said to reek; the other to those thread-like masses which prevail in water: and their flowing, flaccid forms are not inaptly expressed by this almost forgotten word.

(206.) The plants already described will suffice to illustrate several progressive stages of systematic or methodical arrangement; *e. g.* all those which agree in certain fixed characters form a group, and constitute what is botanically called a species, as the long-legged sea-froth-plants, the short-legged sea-froth-plants, &c.; while these two, or a similar association of any other concordant species, form a genus. In this instance, the genus Achnanthes; in another, the genus Diatoma; in another, the genus Fragillaria, and so forth; all which, agreeing in their flattened joints, easily separable into fragments, form a type, called, from the genus Diatoma, the *Diatomaceæ;* the types being always indicated by the termination *aceæ*.

(207.) Other genera form other types, as Globulinia, Protospheria, and Bichatia, the type *Globulinaceæ*, which, with the *Diatomaceæ*, forms the section FRAGILLINÆ; the sections being known by the termination *inæ*, which is generally affixed to the name of the best known or most important genus. In like manner, Nostoc, Palmella, Protococcus, &c., form collectively the type *Nostochaceæ*, which, with the *Rivulariaceæ*, constitutes the section NOSTOCHINÆ.

The *Oscillaceæ*, *Confervaceæ*, and *Ceramiaceæ*, are other types or groups synthetically formed on similar principles, and from their association results the section CONFERVINÆ.

(208.) The sections FRAGILLINÆ, NOSTOCHINÆ, and CONFERVINÆ, combine to form the order CONFERVALES; of which the following table will furnish a synopsis. Three of the types, viz. *Diatomaceæ* [vide § 144 to 148], *Rivulariaceæ* [vide § 153], and *Ceramiaceæ* [vide § 193], admit subordinate groups of genera, called subtypes, which stage of synthesis is marked by the termination *-idæ* or *-eæ;* but, as these are not common to all the types, and are scarcely essential even when found, they are not admitted into the tabular conspectus.

Order.	Sections.	Types.
CONFERVALES	Confervinæ	Ceramiaceæ.
		Confervaceæ.
		Oscillaceæ.
	Nostochinæ	Rivulariaceæ.
		Nostochaceæ.
	Fragillinæ	Diatomaceæ.
		Globulinaceæ.

GEOGRAPHICAL DISTRIBUTION OF THE CONFERVALES.

(210.) From the more equable temperature of the medium in which they live, the range of aquatic, is often much less confined than that of terrestrial plants. Water so far diminishes the heat of the torrid, and moderates the cold of the frigid zones, that several pond and river weeds are known to flourish from the equator to the poles: for example, the European bulrush (Typha latifolia,) has been found in Siberia, North America, Jamaica, China, and the peninsula of Hindostan; our common duck-meat (Lemna minor), which spreads over the whole of Europe, is a native also of North America and Asia, being found in the waters of Pennsylvania and Carolina, as well as in those of Siberia, Tartary, Bucharia, China, Cochin-China, and Japan.

(211.) But, although cosmopolites occur amongst those which are usually considered much superior and more perfect plants, it is a curious fact, that there are very few of these inferior grades which seem able to endure equivalent vicissitudes of climate.

(212.) Confervæ are comparatively rare between the tropics, and, although not entirely confined to the temperate zones, they become gradually more abundant in the higher latitudes, both of the northern and southern hemispheres.

(213.) This is a circumstance deserving especial notice, and the more so, as it is one that could not have been presupposed. Speculation would have suggested that the mud of the Ganges and the Nile, the pools and tanks of Egypt and of India, which swarm with animal life, would not have been less prolific nests of the still simpler forms of plants. But the contrary appears to be the truth; for, whatever allowance may be asked for the less accurate researches that have been made in this department of natural history in extra-European countries than in our own, still the broad fact is sufficiently established: so that of their comparative paucity in warm countries there can be no doubt.

(214.) Connected with the subject of the general geographical distribution of the Confervales, there is a circumstance worthy of remark, not only on its own account, but as indirectly corroborating the statements already made, which, though founded on good evidence, would have been more satisfactory had the examinations been more minute. The hint was first thrown out by Brongniart, that no true Confervæ are found in warm springs. This remark has been since confirmed, and I do not know that it admits of any exception; for those Confervales which have been mentioned as

inhabiting the Bath and similar thermal waters, belong to the type Oscillaceæ; a group which, it will be remembered, [vide § 181,] verge towards the animal kingdom, and which some naturalists of authority have even wished to exclude from the vegetable reign.

(215.) Hence it will appear that the chief geographical range of the Confervinæ, and especially of the types Confervaceæ and Ceramiaceæ, is in the temperate zones; the Confervaceæ abounding both in salt and fresh water; the Ceramiaceæ being exclusively marine.

As the Oscillaceæ occur in hot springs, along with some of the Ulvaceæ [vide § 241, &c.] that inhabit tropical seas, it is very probable that they will be found, on further examination, to approach nearer to the equator than their allies; but of this no direct evidence has been adduced.

(216.) The range of the Nostochinæ appears to be much more extended than that of the Confervinæ; for Palmella, Nostoc, and their allies, are common plants in most temperate regions; while Protococcus abounds not only on the Frozen Mountains, near the North Pole, but is likewise a native of the British Isles, is met with in profusion in the Alpine districts of France, Spain, Switzerland, and Italy, and perhaps even at Paramo, in South America, nearly under the Line [§ 45.]

(217.) Whether this plant be indigenous to all these various latitudes, or only a visiter to some, is at present undetermined; but, as it is most permanent and abundant towards the north, and on mountains having a northern altitude, it is likely that its appearance in more southern regions, and in warmer climates, may be owing to occasional migrations.

(218.) Of the geographical distribution of the Fragillinæ, far too little as yet is known to allow any generalizations to be ventured; but as many of them are either parasites or epiphytes, and others, as the Globulinaceæ, are for the most part peculiar to certain fluids or solutions, it is probable that their distribution will partake more of a local than a general character; and that they will be found to be more affected by accidental circumstances, always varying, than by the physical constitution of a country, or the vicissitudes of climate.

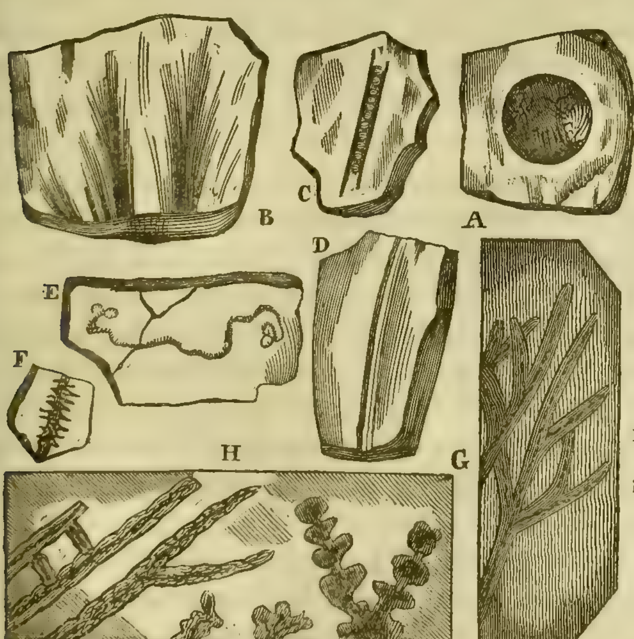
GEOLOGICAL DISTRIBUTION OF THE CONFERVALES.

(219.) The fossil Confervæ of the ancient world appear, by their geological position, as far as it is known, to confirm, in an extra-

ordinary and unexpected manner, the soundness of the conclusions at which naturalists had previously and unpremeditatedly arrived, as to the geographical distribution of the present existing species.

(220.) In the first place, they appear to have been much less common in former times than now, for in the older rocks no traces of them have been ever found, and in the second, to have been unknown during those epochs in which the temperature of the tropics extended further towards the poles. For the vestiges discovered in the upper secondary and tertiary formations are extremely few; and no decided evidence of their existence has hitherto been adduced, even so late as the era of the coal measures, when ferns and palms, and pines, were flourishing with the most exuberant wildness; for the filamentary productions found in the schistous deposits of the coal formations have, as Brongniart well observes, none of the characters of confervoid plants, but resemble more the impressions made by ulvaceous flags, or the aquatic rootlets of still superior vegetables.

(221.) The *Chalk-marl*, nearly at the summit of the secondary series, is the first stratum in which vestiges of decided confervoid plants appear; and here only two species, at most, have been found: these have been figured by Brongniart, in his "Histoire des Vegetaux Fossiles," and described under the names of *Confervites fasciculata*,



A. Confervites? Ægagropilöides (reduced.)
B. Confervites fasciculata.
C, D. Filaments magnified.
E. Confervites thoreæformis.
F. Portion magnified.
G, H. Confervoid markings in agate.

and *C? Ægagropilöides*. The first bears a very considerable resemblance to our present species, *C. ærea* [§ 175, fig. D.], and the latter to our moor-ball, *C. Ægagropila*, [§ 184, fig. A.] or rather to our sea-balls, *Ægagropilæ marinæ*, which are formed by the aggregation of the leaf fibres of Caulinia oceanica. Hence a query is affixed to its generic name; for, no articulations being perceptible, it is a very doubtful Confervites.

(222.) In the tertiary series, another species has been discovered, [§ 221, fig. E. F.], which Brongniart calls *Confervites Thoreæformis*, from its similitude to certain species of the recent genus *Thorea; e. g.* to the T. *ramosissima* of France, or rather to the T. *violacea* brought by Bory St. Vincent from the Isle de Bourbon. Brongniart states this to be the most satisfactory example he has seen of a fossil Conferva: the specimen from which his figure was taken is preserved in the collection of the Marquis de Dré.

(223.) The above-named two species of Confervites are all that have been hitherto discovered and absolutely determined; hence there are not sufficient materials collected to decide how far the various sections of the Confervales could be distinguished, if found in a fossil state. Such a distinction would certainly be difficult, Brongniart thinks almost impossible; at any rate, it would be useless now to subdivide so small a group: therefore, it is agreed that all articulated filamentous fossils shall for the present be associated together, and form the genus *Confervites*, which, should a greater number hereafter be discovered, may become the common name of the fossil section, equivalent to *Confervinæ* among recent plants.

(224.) That further researches will enlarge the group there can be little doubt, for Brongniart mentions having examined, in a collection at Verona, various fragments of marine fossils bearing the impressions of articulated plants, apparently Confervites, of several different species. One fragment, he says, seemed, from the rounded granules towards the ends of the filaments, to bear the impression of a plant similar to some of our modern *Ceramiaceæ*, and several others which were in too imperfect a state to be specifically described, he considered to be associates of the various genera of the same type.

(225.) Confervöid streaks have long been noticed in agates, as to them is owing much of the beauty of the stones; and Daubenton first suggested the idea of their being the vestiges of Confervæ.

Brongniart however believes these markings not to be impressions made by plants, but simple infiltrations. But Mr. M'Culloch and others support Daubenton's opinion that they are the traces of Confervæ, and it is very probable that at least some of them [see fig. G, H, § 221] have a vegetable origin. The above-named gentleman, in his very valuable paper, published in the 2d vol. of the Transactions of the Geological Society of London, in the section that treats of the markings in agates and other chalcedonies, observes, "Among them, however, will be found some exhibiting an organization so decided that no mode of crystallization, or inorganic arrangement, can be conceived capable of imitating it." And it must be confessed that the figures he gives bear out his assertions. In corroboration of this belief, it is also urged, that some species of *Confervales* inhabit hot springs, and that it is in hot springs, such as the Geysers, that silex is held in solution; but to this argument Brongniart replies, that the Confervales found in such localities belong to the type Oscillaceæ, which are, of all, the least like in form to the disputed markings of the agates.

(226.) Two additional supposed species have been figured by Schlotheim as belonging to the genus Confervites; but the one named by Agardh C. Schlotheimii is believed not to be a true fossil, but a modern plant; either a rootlet, or a *rhizomorpha*, that has penetrated a superficial schist; and the second seems to be rather a coralline than a conferva. A third species, figured by Jager, and described under the name of *Confervöides arenaceus*, has likewise been rejected from the genus, its characters being obscure, and its affinity extremely doubtful.

(227.) Thus the species of this order, which, by their fossil remains, have been decidedly recognised as denizens of the ancient world, are but two, and, even including the doubtful and undetermined markings, the amount still remains very small. So that either all vestiges of these plants, if they were formerly as abundant as they are now, must have been wiped out, which there is no reason for supposing, or the physical condition of this planet must formerly not have needed the services they now perform; or have been at one time incompatible with their existence, and at another unfavorable to their increase.

(228.) Thus the geographical and geological distribution of the Confervales curiously coincide, and the facts collected on either hand as curiously confirm each other. For, as in our own time, these plants abound in temperate regions and are unknown, or

few in warmer latitudes, so likewise in former eras, when, from other evidence, it is believed that the temperature of this globe was higher than at present, geological researches affirm that they were, in like manner, either absent, or as scantily produced.

(229.) Thus is the first link of an astounding chain of testimony secured; for, from the beginning, there were natural witnesses of Nature's works, and natural records kept; and these humble plants will perhaps afford one of those scattered sybil leaves, which, if rightly arranged, may unfold, in part, the ancient history of the world.

FUCALES.

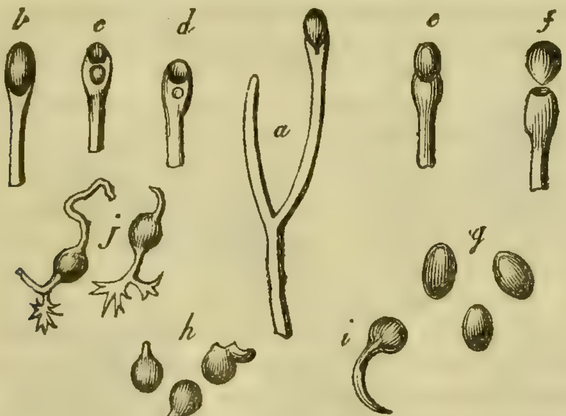
(230.) The Lavers or washworts (*Ulvinæ*), with the curious river-wrack (*Lemania*), and the sea-weeds or wrackworts (*Fucinæ*), shew in their several types and species, still further progressive stages of development, and modifications both of external and internal structure. The slimy thallus is in them generally absent, or, if present, seldom observable. Sometimes, as in the *soft skin* (*Codium*), it is altogether obsolete; these plants being, as Greville states, totally destitute of epidermis: and in others, though present, it is for the most part very obscure, having become a mere film, and often being undistinguishably blended with the more or less condensed series of cells that constitute the membranaceous, cartilaginous, and coriaceous teguments, of a vast majority of the species.

ULVINÆ.

(231.) Siphonaceæ. On the confines of the preceding and of the present orders, there are certain plants which may be termed transitional; once indeed they were esteemed *Confervæ*, and placed in the genus *Ectosperma*. But although more accurate observations have shewn them not to be confervine plants at all, as formerly supposed, still they are evidences of the connexion between the (*Ceramiaceæ*) vase-worts, of the Confervinæ, and this first type of the *Ulvinæ*, or Lavers, amongst which they are now arranged.

(232.) In honour of M. Vaucher, a most meritorious Algologist, the first genus in the type, has been named *Vaucheria:* and the clubbed-tipped species (*V. clavata*), if no fallacies vitiate the accounts given of it by Unger, is one of the most paradoxical plants existing; for, notwithstanding its distance from the Zoocarpes, it resembles, in some of its transitional metamorphoses, those very curious fruit animalculæ.

(233.) The account given by Unger is shortly this:—That the club-shaped reproductive vesicles that terminate the divisions of the plants, when separated from the fronds on which they grow, swim about like animals possessing sensation and volition. And, furthermore, that after exhibiting this restless activity for nearly



(*a*) Portion of Vaucheria clavata, in fructification.
(*b, c, d, e, f*) a series of views of the fructifying summit, shewing the gradual expulsion of the contained globule. (*g*) Globules as they appear in their animated state. (*h, i, j*) Globules germinating and commencing the vegetable term of their existence.

an hour, they lose their seeming animality, become torpid or stationary, and in a short time put forth first a radicle, then a stem, attach themselves to the nearest substance, grow like plants, and in about eleven days arrive at maturity, bearing animalcular fruits similar to those from which they sprang. These observations, singular as they seem, M. Unger says, he made repeatedly with the same results.

(234.) Unger's account of his observations upon the natural history of this plant, are too curious not to be given, as far as possible, in his own words. I therefore quote, with occasional necessary abridgments, the translation of his memoir, with the figures which appeared in the fourth number of the Magazine of Natural History.

(235.) He says, that "on the 5th of March he found near Vienna, in a ditch containing some clear water, derived from the melting of snow, a Conferva, which in four days produced fructification, and he knew it by the green globular summits to be the *Conferva dilatata* of Roth; *Ectosperma clavata* of Vaucher; or *Vaucheria clavata* of the present day.

While watching attentively the growth of this plant, he perceived that the globule, which terminated one of the filaments, "became gradually darker in its colour, and a little transparent at its extremity; in the middle it was evidently

somewhat contracted, and had some trace of spontaneous motion." He then continues: "I could scarcely believe my eyes when I perceived the contraction to become more decided, and a cavity to be formed at the base. The contraction at length divided the globule into two smaller globules, which moved spontaneously towards the summit. As the developments proceeded, the cavity of the uppermost globule became enlarged, while the inferior globule diminished. The latter at length disappeared, and the remaining large globule escaped by a terminal orifice, ascending till it reached the surface of the water. The whole of this process occupied about thirty seconds; but from subsequent observations it may be stated generally to take up a minute.

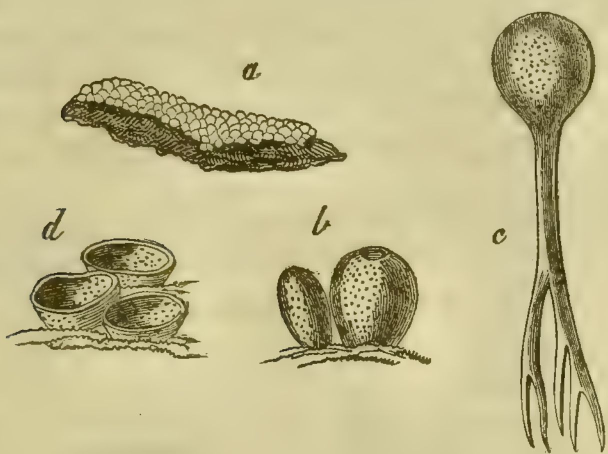
"As I continued my observations, I happened to look at the surface of the water, and was not a little astonished to find it covered, especially towards the side of the vase, with minute globules, unequal both in colour and size. Many of them swam freely here and there, moving at their option, in one way or another, retiring and approaching one another, gliding round globules that were motionless, stopping, and again setting themselves in motion exactly like animated beings. Conjecturing the identity of the green globules that possessed motion with those that had none, I immediately began to examine whence these infusory animalcules derived their origin, and what relation they bore to the green globule and the fructification of the conferva.

"The next day I perceived a great number of the globules aggregated around the bubbles of gas, disengaged from the conferva, and floating at the surface. There were some of them of a dark-green colour, and either round or elongated; others more transparent, tumid, and with one or two appendages diverging from or at right angles with each other; these were evidently plants in a state of germination; other globules again were oval, very dark at one extremity, and almost transparent at the other; these swam about freely. Within the space of one hour, I succeeded in tracing not only the diminution of vitality and death of the infusoria, but also the subsequent development of the dead animals into germinating plants, in such a manner as to establish the truth of the fact. But on the 12th of March, I had the pleasure of ascertaining distinctly the origin of these minute bodies. I undertook to observe, without interruption, one of the tubercles of fructification which I have already mentioned as terminating the filaments, in order to discover what became of the green matter enclosed within it. I had observed it for the space of half an hour, when the series of changes just detailed commenced, and the previous observations were indisputably confirmed. Towards the close of their hour of animal existence, the globular form of these corpuscules becomes elongated, and this change of form, with an equal diffusion of the green colouring matter, are the first signs of this epoch of their life drawing to a close. In about six hours the globule has become much more transparent, and puts forth an appendage, and, on the third day, a second one, by which the young plant becomes fixed to the side of the glass vase, or any other body in contact with it. About the eleventh day the fructification of the new plant is apparent at the summit of the principal branch, and the cycle of events is repeated as before."

(236.) The histories of other *Vaucheriæ* are much less extraordinary than Unger's account of the Vaucheria clavata. Their fronds are continuous capillary tubes, containing multitudes of

dark-green granules attached to the hollow stems and branches, and producing fructifying conceptacles on various parts. These are well figured by Greville, in his beautiful work on the British Algæ, in which he has completely reduced this once obscure and difficult order to the rule of system. As far as possible the present sketch shall be made to coincide with his arrangement, and his lucid definitions will in general be adopted.

Botrydium granulatum.



(*a*) Group of plants, natural size. (*b*) Plants growing, magnified. (*c*) Entire plant shewing its root. (*d*) Old plants collapsed.

(237.) The *Botrydium* or *grapelet*, (*Grev. Alg.* pl. xix.) is perhaps the most simple of the section, for it appears to consist of but one conceptacle, containing a watery fluid; after the contents of the vesicles are discharged they become cup-shaped, and being crowded together in large patches, resemble the thin crust of an order, hereafter to be described, under the name of *Lichens.* But although the superior axis of these plants is abortive, the inferior is produced in the form of a fine root, the length of which often exceeds the diameter of the conceptacle four or five times.

(238.) The *Sea purse* (Codium Bursa), is a rare and curious example of this group. It is a hollow, subglobose plant, somewhat resembling a gigantic Botrydium without a root. Its attachment to rocks is but slight, and when found it is generally free. (Vide *Turner's Fuci*, t. 136.)

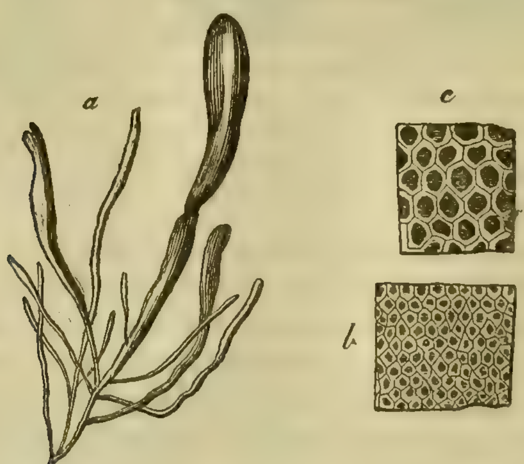
(239.) These, with several other similar vegetables "of an herbaceous green colour, growing either on damp ground, in fresh water, or in the sea," are associated to form a type, called, from the normal genus, *Siphonaceæ.* The following are the chief cha-

racteristics of the group, whether synthetically or analytically considered: "Fronds membranaceous and continuous; figure various, composed of simple or branched tubes, globular, cylindrical, or flat, solitary, or collected into a lax spongy mass; fructification, as in the Ceramiaceæ, external, and consisting of vesicles (sporidia) filled with dark-green granules (sporæ.)"

(240.) Greville calls this group *Siphoneæ;* but, as it is very desirable that the names of all the types and sections should have similar terminations, as indicative of similar stages of analysis, it may probably be deemed excusable to change it to *Siphonaceæ*, which word will better correspond with Ulvaceæ, Fucaceæ, &c. names already established; the termination *-idæ* or *-eæ* being reserved to indicate the subtypes, whenever they are required to be noted.

(241.) *Ulvaceæ.* The Enteromorpha, or *water-gut*, [*Grev. Alg.*, pl. xviii.] receives its name from the intestine-like appearance of

Enteromorpha compressa.



(*a*) Entire plants. (*b, c*) Portions magnified to shew the cellular structure.

the fronds, some of which are round, some flattened, and some puckered, as if attached to an invisible mesentery.* The *ulva*, or true *water-wash*, shews in its different species the various degrees of compression that the tubular frond undergoes until the cavity is obliterated, or filled with cells. *Ulva crispa* and *bullosa*, the bladder and curled lavers, being hollow and inflated, the *ulva*

* The fronds vary in length from a few inches to three feet, and when distended with water, very much resemble the intestines of an animal floating in the stream.

lactuca, or lettuce laver, partly plane and partly inflated, while the *ulva latissima*, or oyster-green, spreads abroad a wide flat frond. So abundant are these plants in many places, that they become a serious obstruction to the fishermen, by clogging their nets. The ulvæ are always green, and hence they are with facility distinguished from the *Porphyræ*, or *slokes*, which are more commonly brought to table under the name of lavers than those plants to which the term *ulva*, as now restricted by botanists, is legitimately applied. But all are frequently eaten, and the one substituted for the other; and even the ulva compressa, which is disregarded by us, is esteemed as a food by the natives of the Sandwich Isles.

Some ulvæ are remarkable for the high temperatures they will endure, growing as they do in hot springs, *e.g.* U. thermalis flourishes in those of Gastein, the heat of which is about 117° of Fahrenheit.

(242.) The *Porphyræ* are distinguished from the other ulvaceæ by their purple colour; they contain much viscid gelatine, and are very nutritious; nevertheless, although abundant, they are rather regarded as luxuries than as common articles of food; and are seldom met with but at the tables of the great: *Porphyra laciniata* and *P. purpurea*, are the species most frequently collected.

(243.) The *Porphyræ* or slokes, the *Ulvæ* or lavers, and the *Enteromorphæ* or water-guts, with other similar plants, constitute together another type belonging to the same section, which, as they were formerly all called *ulva*, and as ulva must still be regarded as the normal genus, are collectively denominated *Ulvaceæ*, or laver-worts. This type is easily distinguished from the Siphonaceæ, or lather-worts, the only other one with which it can be confounded, by having the spores internal, while in *Siphonaceæ* the conceptacles are without the general mass of the frond; and hence the Ulvaceæ have been sometimes called the *Entospermeæ*, while the siphonaceæ might be named, from the contrary character, *Ectospermeæ*. Like the *Siphonaceæ*, they are both terrestrial and aquatic plants, some growing on damp ground, and others either in fresh water, or in the sea; many of them abound in the mouths of rivers, and in salt water ditches. The frond, which is either flat or tubular, has a very small scutum or shield-like base, and the imbedded spores often assume a quaternary arrangement.

(244.) Lemaniaceæ. The curious *Lemania*, or river-wrack, at one time arranged with the *Confervæ*, and at another with the *Fuci*, appears rather to be an associate of the *Siphonaceæ* and *Ulvaceæ*, and to form the link of connexion between these types and the following section. The structure of this singular genus, *i. e.* the leathery consistence and olive hue of its continuous non-articulated frond, will demonstrate its affinity to the *Fucinæ*, but in habit it totally varies from all known genera of that, or the allied section, the *Florinæ;* for while they are invariably marine plants, the Lemaniæ are exclusively confined to fresh water, delighting in mountain torrents and impetuously running streams. The fructification is likewise peculiar, consisting of moniliform articulated sporidia, growing from the internal surface of the tubular frond, or within enlarged cellules, obscurely visible from without. The sporidia separate when mature, and germinate. Agardh, acting on the general acknowledgment of these peculiarities, has very properly made it the type of a separate group; and in this he is followed by Hooker, and most other botanists, who adopt his definition of the type.

(245.) The *Siphonaceæ*, *Ulvaceæ*, and *Lemaniaceæ*, form collectively the section called, from the most important and best known type and genus, the Ulvinæ. The affinities of this group with the preceding order are twofold, for the *Entospermatous Ulvaceæ* are allied especially with the *Entospermatous Confervaceæ;* and the *Ectospermatous Siphonaceæ* with the *Ectospermatous Ceramiaceæ;* the whole series being removed from the Confervas, and at once distinguished as a section of the order Fucales, by their continuous non-articulated fronds.

(246.) The connexions of the Ulvinæ with the following order is necessarily of a closer kind, but their membranaceous fronds afford in almost every case a sufficient diagnosis; and whenever, as in *Lemania*, the connecting genus, this character fails, their internal fructification and fresh water habitat will at once separate any doubtful species from the Florinæ and Fucinæ, which are universally marine.

FLORINÆ AND FUCINÆ.

(247.) In the *Ulvinæ*, the cells of which the plants are composed, when not naked, as in *Codium*, are in general covered by a

delicate reticulated membrane, which is seldom met with in a coriaceous state; but in the following sections, *Florinæ* and *Fucinæ*, which are all sea-plants, the tegument becomes more and more firm, proceeding from the membranaceous texture of *Halymenia*, the sea-film, to the gristly and the leathery coverings of the *Chondrus*, or sea-gristle, and *Himanthalia*, or sea-thong.

(248.) These plants likewise shew the scheme of its formation, and the distinction of the cellules, according to their compression and condensation into different textures, the inner loose cellular structure into which fluids are absorbed being termed the *Enchyma*, and the tegument enclosing the whole the *Ep-enchyma*. The first has commonly been denominated the pulp or *par*-enchyma, but, from the circumstance of there being several forms of pulp, and *par*-enchyma being but one modification, while *pros*-enchyma is another, *Enchyma*, or simply pulp, may be the better collective term, [§ 253, 258.]

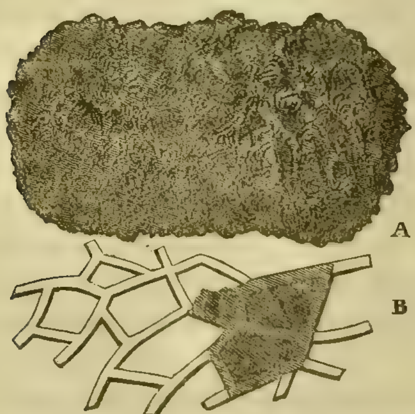
(249.) The tegument likewise is not here a cuticle, and the old name, *epi*-dermis, is certainly untenable in these cases, where there is no *dermis*, or skin, for it to be upon. The formation of this *ep-enchyma*, by the compression of the cells of the *enchyma*, is well seen in a section of the *Catenella*, or chain-let, and many others, [vide § 254, 259, &c.]

(250.) The British seas afford examples of most of the types of these two very extensive sections, which, although intimately allied, have been, from the colour of the fronds, distinguished into two groups, the *Florinæ* and the true *Fucinæ*: the first of which are of a membranaceous or cartilaginous structure, and seldom change much in drying; the second, or true *Fucinæ*, are more or less densely fibrous, and mostly become of a dingy black when dried. In the fresh state likewise, the *Florinæ* have showy pink or purple fronds, the sporidia being also purple, while in the *Fucinæ* the fronds are of an olive-green, and the sporidia black. These characters, however, which in general hold good, admit of some exceptions, as indeed do all natural definitions, if they attempt to *divide* continuous series, when the object should rather be, even when analysing and distributing the genera in groups, to point out their various connexions.

FLORINÆ.

(251.) Of two out of the six types into which the *Florinæ* are distributed, there have not as yet been found any examples in the British Marine Flora, viz. of the *Thaumasiaceæ*, or wonder-worts, and *Caulerpaceæ*, or creeper-flags; but these two sections each contain only one known genus.

(252.) Caulerpa, the creeper-flag, is characterised by its greenish membranaceous frond, with creeping offsets from the root, It is a native of the equatorial seas, and is also found on the southern coasts of New Holland, [vide fig. A. B, § 259.] Thaumasia,



Thaumasia ovalis.

A. Entire plant reduced.
B. Portion magnified, to shew the retiform skeleton with its investing membrane.

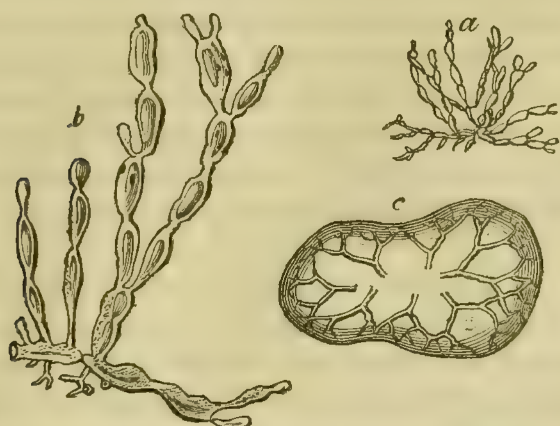
or the wonder-wort, is equally well distinguished by its extraordinary skeleton. The only figure I have been able to find is that given by Agardh, in his "Icones Algarum," and from it the accompanying sketch is taken. Agardh says, "This genus is of so singular a nature, that it is difficult to say whether it should be arranged among the Zoophytes or the Algæ. It is an alga with a skeleton, the skeleton is that of a zoophyte, but the softer parts are those of a flag. The skeleton or frame-work consists of meshes formed of hard filaments about the size of a hog's bristle, rigid, fragile, and of a shining brown colour; internally they are solid, not tubular. The foliaceous substance with which the network is overspread, is thin, flexible, and blackish, rather resembling the fronds of Rhodomela, [§ 259.] Agardh concludes, by observing, that it will be seen, from the above description, that he is fully justified in giving it the name of *Thaumasia*, *i. e.* wonder-

wort. The specimen sent to him and figured, being of an oval shape, he has added *ovalis* as the specific denomination. This plant was found by Konig, in the roads near Ceylon. Linnæus called it *Fucus flavus*."

(253.) The *Gastrocarpaceæ*, [*Grev. Alg.* pl. xvii.] known by their ribless veinless fronds and cellular epenchyma, enclosing a gelatinous Enchyma in which the sori are imbedded, contain the *Irideæ*, or dulses, one, if not more species of which, as the *Iridea edulis*, is a favorite food with many crustaceous animals, as lobsters, crabs, and cray-fish: it is likewise eaten by fishermen, both raw and roasted. When properly dressed, it is said to taste like roasted oysters.

(254.) Here also will be found the *Catenella opuntia*, or the

Catenella opuntia.



(*a*) Tuft of plants, natural size. (*b*) Plants separated. (*c*) Transverse section of frond, to shew its internal structure.

chainlet, and likewise the Halymeniæ, or sea-membranes, one of which, the dulse (*Halymenia* or *Rhodomenia palmata*,) was formerly dried and chewed as a luxury by the Scotch and Irish; it has the flavor of violets, and is very pleasant in the mouth; but, as Johnston observes, it has now been almost supplanted as a masticatory by the less agreeable tobacco. It is still however, in a raw state, occasionally eaten by the common people, from a belief in its being a sweetener of the blood, and a remedy for scorbutic complaints. "There is," says Mr. Neill, "a common saying in Stronsa, that he who eats of the dulse of Guiodin, and

drinks of the wells of Kildingie, will escape all maladies except black death."

(255.) To the Icelanders, H. palmata is a plant of considerable importance. They prepare it by washing it well in fresh water, and exposing it to dry, when it gives out a white powdery substance, which is sweet and palatable, and covers the whole plant; they then pack it in casks to keep it from the air, and thus preserve it, ready to be eaten either in this state with fish and butter, or, according to the practice of wealthier tables, boiled in milk, and mixed with a little flour of rye. The cattle are also very fond of this sea-weed, and sheep are said to seek it with such avidity as often to be lost, by going too far from the land at low-water."—*Quart. Rev.* vii. 68.

Hence it has sometimes been called *Fucus ovinus*, or sheep-dulse: the name dulse (*q.d.* dulcis) having reference, doubtless, to its sweet taste. This species (R. palmata) is the true "saccharine fucus of the Icelanders, and is consumed in considerable quantities, not only in Iceland, but also throughout many of the maritime countries of the north of Europe, and in the Grecian Archipelago." *Grev.* In Kamtschatka it is fermented by the natives, its saccharine matter being so abundant that it affords them an exhilarating beverage.

(256.) The *Floraceæ* are distinguished by their brilliant and little changing tints, their foliaceous fronds, and the segregation of their spores in conceptacles or sori; or, if scattered, by their assuming a ternate disposition, the *Rhodomela*, or rose-black, the *Laurencia pinnatifida*, or pepper dillosk, and the *Chondrus crispus*, or carrageen-moss, are good and familiar examples of this section. The former used to be eaten in Scotland; and in Ireland the latter is still collected for food. Lately, indeed, it has found its way to the London markets; and it is preferred by some persons to the so-called Iceland moss. It contains an abundance of mucilage, and is employed by frugal housewives as a substitute for isinglass, in the manufacture of blanc-mange and various jellies. Steeping it for sometime previous to boiling, is said to remove its bitter flavor; which, however, as a slight tonic, is one recommendation to its use in consumptive cases.

(257.) A tropical Gelidium, some species of which genus inhabit our seas, is said to be the substance collected by the swallows,

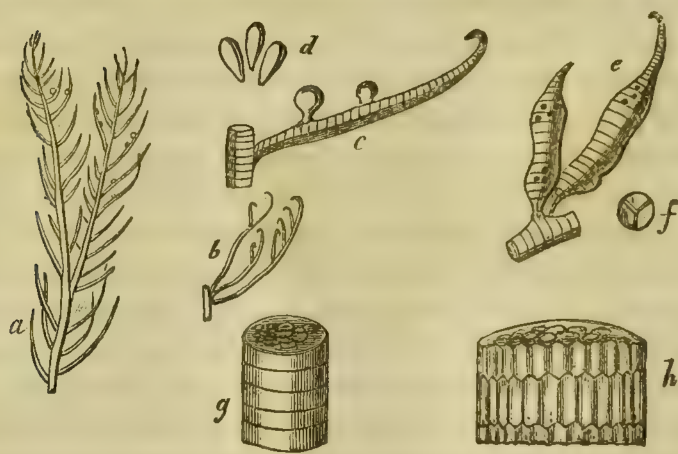
and used in the construction of the edible nests of Java. The taste for birds' nests as an article of food, strange as the fashion may appear to us, is so strong in China, that their collection and importation employs a vast number of persons, and forms a very important and lucrative branch of commerce. It has been estimated that 242,400lbs. of birds' nests, worth there £234,290. and upwards, are annually exported from the Indian Archipelago. "The only preparation the birds' nests undergo is that of simple drying, without direct exposure to the sun; after which they are packed in small boxes. They are assorted for the Chinese market into three kinds, according to their qualities; and the common price for birds' nests of the first sort at Canton, is no less than 3500 Spanish dollars the pecul, or £5. 18*s*. 1½*d*. per lb.; for the second, 2800 Spanish dollars the pecul, and for the third, 1600." From these prices, it is evident that the birds' nests can be no more than an article of expensive luxury. They are consumed only by the great; and indeed, the chief part is sent to the capital for the consumption of the court; and, such is the extraordinary demand for this description of food, and so enormous the price, the best being sometimes worth nearly their weight in gold, that in China, to say that a man eats birds' nests, is equivalent to saying that he is a grandee, or a person of great opulence.

(258.) The collecting birds' nests appears from Mr. Crawford's account, to be as perilous a toil as our fearful trade of gathering samphire; for he says, the nests are obtained in deep and damp caves, and are most esteemed if taken before the birds have laid their eggs. The coarsest are those collected after the young have been fledged. The finest nests are the whitest, that is, those taken before they are defiled by the young birds. They are taken twice a year, and if regularly collected, and no unusual injury offered to the caverns, the produce is very equal, and the harvest very little, if at all, improved by being left unmolested for a year or two. Some of the caverns are extremely difficult of access, and the nests can only be collected by persons accustomed from their youth to the office. In one place the caves are only to be approached by a perpendicular descent of many hundred feet by ladders of bamboo and rattan, over a sea rolling violently against the rocks. When the mouth of the cavern is attained, the perilous office of taking the nests must often be performed by torch-light,

by penetrating into the recesses of the rock, where the slightest trip would be instantly fatal to the adventurers, who see nothing below them but the turbulent surf making its way into the chasms of the rock.—*Crawford's Eastern Archipelago.*

(259.) The *Rhodomela* pinaströides, or rose-black, is a very

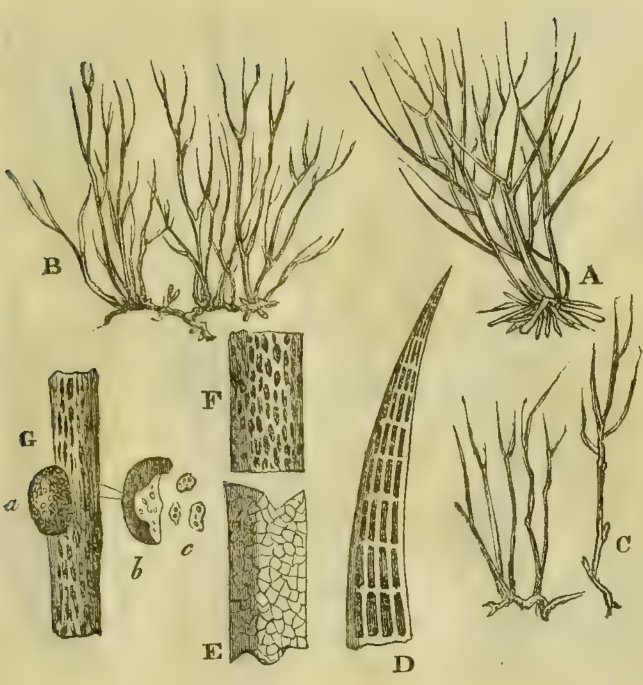
Rhodomela pinaströides.



(*a*) Branch with round conceptacles. (*b*) Ditto with long conceptacles. (*c*) Piece of *a*, magnified. (*d*) Spores, (*e*) Long conceptacles containing ternate granules. (*f*) A ternate granule. (*g*) Portion of frond, to shew its pseudo-articulated appearance. (*h*) Section to exhibit internal structure, and shew on what the pseudo-articulated appearance depends, viz. the parallelism of the cellular structure.—*Grev. Alg.* pl. xiii.

elegant illustration of this type, and the Corsican worm-grass, *Gigartina* (or sphærococcus) *Helminthocorton*, is another example. The latter grows abundantly in the Mediterranean, and is celebrated on the Continent as a vermifuge, under the name of Coralline of Corsica. It has also been recommended as a remedy in cancer. In this country it is scarcely ever used.

The *Plocamium*, or hair-flag, is too beautiful an example of this type to be passed unmentioned. Its collection and preparation afford employment, and yield no inconsiderable profit to many poor people on our coasts. Its elegant varieties in form, and brilliant colour, have rendered it a universal favorite. It is the weed chiefly used in the construction of landscapes, once a fashionable art, though not now in vogue.



A, B, C. Plants of Gigartina Helminthocorton, natural size. D. Summit of a frond magnified. E, F. Portions still further magnified. G. Portion with fruit. (*a*) Tubercle of fructification. (*b*) Conceptacle open, and spores discharged. *Nees v. Esenbeck.*

(260.) *Spongiocarpaceæ* and *Furcellaceæ.* The genera *Polyides*, or sea wort-reet, and *Furcellaria*, or sea fork-let, each consisting of but one known species, mark the transition by their structure from the *Florinæ* to the *Fucinæ;* and although of each there is but one known species, yet so different are they from each other and from the rest of the Algæ, that both genera have been very properly separated by Greville and made typical of independent groups, the first being called *Spongiocarpaceæ*, and the second, *Furcellaceæ*, [§ 262, fig. C, D.]

(261.) *Spongiocarpaceæ.* The colour, habit, and general structure, indicate the affinity of the *Spongiocarpaceæ* with the *Floraceæ*, but the naked spongy wort-like sori of Polyides, formed by clusters of wedge-shaped sporidia intermixed with radiating filaments, at once distinguish it from that, as well as from all other sections, [vide § 262, fig. D.]

(262.) The *Furcellaceæ* are likewise as well distinguished; for,

A. *Caulerpa pinnata.* (*a*) Creeping root. (*b*) Portion magnified. (*c*) Pinna marked with spots.

B. *Caulerpa taxifolia.* (*d*) Shoot rising from the creeping fronds. (*e*) Pinna, separate and enlarged.

C. *Furcellaria lumbricalis.* (*g*) Entire plant. (*h*) Fructification in apex of frond. (*i*) Longitudinal section of ditto. (*j*) Horizontal section. (*k*) Spores.

D. Polyoides rotundus. (*l*) Plant with Fructification. (*m*) Apex with fruit removed. (*n*) Transverse section. (*o*) Spores. (*p*) Sporidia mixed with fibres.

although the appearance of *Furcellaria* [vide fig. c.] is something approaching to the *Fucinæ*, and although like them it is of a less brilliant colour than most of the *Florinæ*, and becomes darker on exposure to the atmosphere, still its fronds are not fibrous; and its terminal conceptacles, with horizontal circular strata of dark oblong-pearshaped spores, will distinguish it sufficiently from the beforenamed sections.

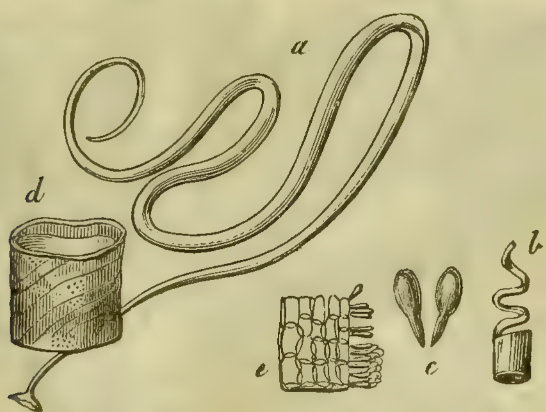
(263.) Collectively, the types *Furcellaceæ*, *Spongiocarpaceæ*, *Floraceæ*, *Thaumaceæ*, *Gastrocarpaceæ*, and *Caulerpaceæ*, form the extensive section *Florinæ*, which with *Fucinæ* immediately to

be described, and *Ulvinæ* previously examined, constitute an order sometimes called pre-eminently *Algæ*, sometimes *Phycæ*, sometimes *Thalassiophytes*, or Thalassiophycæ, but for which, a word either compounded of the two most important sections, types, and genera, or derived from one of them, would be a preferable name, [§ 289.]

FUCINÆ.

(264.) Dictyotaceæ. The sea networks, forming the first type of this section, are well characterised by the beautifully reticulated texture of the tegument, whence indeed the name *Dictyotaceæ*, which has been given to the group, from its normal genus *Dictyota*. The fronds are of various forms, but in all, excepting *Halyseris*, the sea-endive, ribless; and the conceptacles are pellucid, inclosing the sporules, which are for the most part produced beneath the epenchyme.

(265.) The Peacock's tail, or *Padina pavonia*, affords a beautiful example of this section; but *Chorda filum*, sea-whiplash, or



(*a*) Chorda Filum. (*b*) Portion of frond artificially unrolled to shew its spiral structure. (*c*) Spores magnified. (*d*) Portion in fructification. (*e*) Section, to shew internal structure.

sea-catgut, is perhaps a more familiar instance. This plant is often found thirty or forty feet in length, and Lightfoot says, the Highlanders twist it, when skinned, into fishing lines. And so abundantly does it sometimes grow that, as Mr. Neill declares, it is with difficulty a pinnace can make its way through oceanic meadows of this weed.

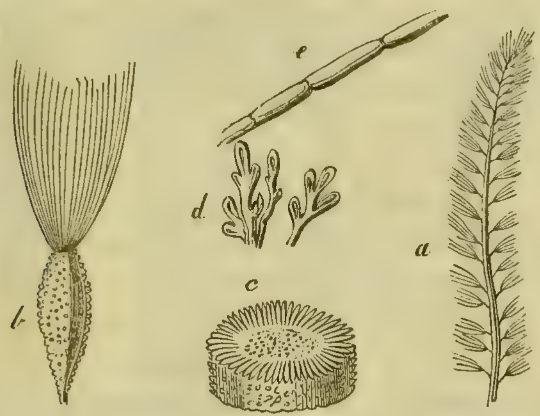
The frond of this cord-like flag is hollow within, and the channel interrupted at short distances by transverse partitions, the use of which, according to Colonel Stackhouse, is to confine the air, or elastic vapour, to certain spaces; so as to act like swimming bladders and increase the buoyancy of the plant, which extends itself to such an amazing length, and always shoots upwards to the surface.

(266.) The smell of (Halyseris) the sea-endive, the only genus with a ribbed frond, is said to be, "when fresh gathered, extremely powerful and disagreeable."

(267.) *Chordariaceæ.* The *Chordaria*, or sea-whipcord, which differs from all other Algæ by its *solid* filiform cylindrical frond, even although the fructification is very imperfectly known, has been arranged in a separate section by Greville, who thinks, "its singular structure removes it from all the other orders;" and hence it is the only known example of the *Chordariaceæ*, or twine-wracks.

A. *Macrocystis pyrifera.* B. *Laminaria buccinalis.* (*a*) Transverse section of stem. (*b*) A portion magnified to shew structure. C. *Chordaria flagelliformis.* (*c*) Transverse section of frond with fruit. (*d*) Fibres and sporidia. (*e*) Spores still further magnified. (*f*) Longitudinal section of frond magnified with one of the fibres.

(268.) *Sporochnaceæ*. Another type of this section, the *Sporochnaceæ*, which contains the genera *Sporochnus*, or scatter-tuft,

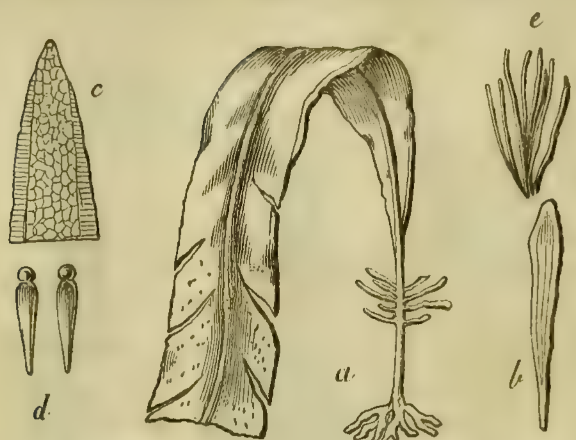


(*a*) Sporochnus pedunculatus, natural size. (*b*) A receptacle terminated by its tuft of filaments. (*c*) Section of the receptacle. (*d*) Filaments with their fertile summits. (*e*) Portion of a filament of the receptacle.

Dichloria, or changeling, and a genus named in honour of Desmarest, *Desmarestia* or *Desmia*, is chiefly characterized by bearing little tufts of fine green filaments on the fronds, but which are deciduous in some, and not yet observed in all the species. The fructification is collected in tubercles, either stalked or sessile. These plants, which are all marine, and of an olive or yellowish green colour, although they do not change to black in drying, become flaccid on exposure to air, acquiring a verdigris colour, and then possess the curious property of rapidly decomposing other delicate Algæ in contact with them.—*Grev.*

(269.) The sea-belts, or sea-girdles (*Laminaria*), the murlins, honey-ware, or bladder-locks (*Alaria*), with the interminable (*Macrocystis*), [§ 267, fig. A.], or bladder-thread, form, with a few other allied genera, such as *Durvillæa*, *Lessonia*, and so forth, a very natural and well-marked type, called, from their flattened form, and from *Laminaria*, or tangle, the name of the normal genus, *Laminaceæ*, or tangle-wracks; by Bory St. Vincent and Greville they are denominated Lamin*arieæ*; this termination, however, as in the other cases where a similar alteration has been made, is only changed from the manifest expediency of designating similar grades of analysis by somewhat similar words.

Alaria esculenta.



(*a*) Immature frond. (*b*) Fructiferous leaflet, of a mature plant. (*c*) Section, to shew internal structure. (*d*) Spores. (*e*) Filaments issuing from minute pores in the frond. *Grev. Alg.* iv.

(270.) The *Laminaceæ*, or tangles, are all marine, and their structure densely fibro-cellular; the fructification is collected in *sori* on the surface of the frond, which rises from a more or less divided rhizoma, and forms a longer or shorter stipes terminating in a plane expansion, either entire or divided; and sometimes ribbed. These plants are chiefly coriaceous, occasionally membranaceous, and become but little changed in hue on exposure to the air.

(271.) The frond of Laminaria esculenta varies from six to twenty feet in length, with a midrib extending the whole way. The midrib, stripped of its membrane, is the part preferred as food; but in some places, particularly in Orkney, Neill observes, that, the pinnæ are also eaten under the name of ‘mirkles,’ or murlins; they are said to be pleasant, but to leave, when chewed in any considerable quantity, a tenacious crust on the roof of the mouth which, while it remains, is very disagreeable.—*Drummond.* It is recommended in the cure of a disorder called pica, to strengthen the stomach and restore the depraved appetite to a healthy state. —*Hooker.*

(272.) *Laminaria saccharina*, or the sugar-sea-belt, has been said to be eaten by the Icelanders; and by some it is reported, that in Norway the cattle feed on it; but Wahlenberg declares, “ that cattle will not touch it, and that its common name in Nordland is *Troll-tare,* which signifies that it is only fit for the sea-

devil. This diversity of opinion is probably owing not so much to difference of taste, as to the fact of the Laminaria saccharina, not being the Icelandic eatable, fucus saccharinus, which is the Rhodomenia palmata already described, the two having been frequently confounded." Thunberg tells that "in Japan it is prepared in such a manner as to be quite esculent, and that it is customary there, when presents are made, to lay upon them a slice of this fucus attached to a piece of paper folded in a curious manner, and tied with threads of gold and silver."—*Hooker.*

(273.) All the species, however, though not good as food, form excellent manure; and the farmers on our coasts avail themselves of what they call sea-furbelows and furbelowed-hangers, to enrich their lands.

Laminaria digitata, or sea-wand, is still, according to Greville, eaten in Scotland, and cried about the streets of Edinburgh as *tangle*. When cooked, the young stalks are not unpleasant; and in some places cattle are also fed on this plant when it has been boiled. The stipes, says Neill, are sometimes made into knife handles, which, after a few months' exposure to the air, become hard and shrivelled, and scarcely to be distinguished from hartshorn.

Johnson, in his Berwick Flora, states that "the *Laminaria digitata*, in some places of the western islands of Scotland, forms even a sort of soil on the pebbles of the beach, on which the poor natives sow barley; and as the sea-weed rots, the grain drops with it into the interstices, so that, when the harvest is ready, it is seen growing on a surface of naked polished pebbles." Sea-weeds, especially some of the Fucaceæ, as F. serratus, are found by experience to form an excellent manure for grass-lands, which yield abundant crops of hay if overspread with cart-wrack, as the husbandmen call it, during the winter. Captain Carmichael also says, that it is peculiarly adapted to potatoe culture; but that its application should not be deferred till the time of planting, as then the tubers are apt to become watery and ill-flavoured.*

*"A very curious circumstance is mentioned by Charles Mackintosh, Esq., who tried the effects of kelp manure upon potatoes, at Crop-basket, near Glasgow. A severe frost, which occurred in September, injured and blackened every lot of potatoes to which the kelp had not been applied, while the kelp lots remained in perfect foliage, even when the respective drills were contiguous. It would appear that the soil, for the time being, had acquired a property equivalent to a certain degree of atmospheric temperature, or, rather, that the nourishment absorbed by

(274.) In some of the Laminaceæ the stipe is hollow, which circumstance, as in *Chorda filum*, seems to be a preparation for the air-bladders which in Fucaceæ are so common, and serve to float the plants. Even amongst these flat-tangles one species, the *Macrocystis pyrifera*, [vide §267, fig. A.] or everlasting bladder-thread, is furnished with vesicles, which appear essential to enable the weak yet lengthened divisions of its almost interminable frond to reach the surface of the water from the depths of the profound abysses in which it grows. This plant is said by sailors to have been found from 500 to 1500 feet in length. The present section, indeed, includes some of the longest and largest Algæ known. Lessonia fuscescens is described by M. Bory St. Vincent as being as thick as a man's thigh, and from twenty-five to thirty feet long. Laminaria bulbosa has a head so large, that a single plant is a load for a man. Laminaria digitata has a stipe about as thick as a walking-stick, and the frond divides at the summit into many belts, and, from its growing gregariously, tracts of this plant somewhat resemble submarine forests of palms. The Laminaria potatorum furnishes the aborigines of Australia with a portion of their instruments, vessels, and food; and Laminaria buccinalis [§ 267, B.] has a hollow stem, which the natives of the Cape of Good Hope convert into trumpets; and hence its common name of sea-trumpet, or horn-weed, [vide *Grev.*]

(275.) The *Durvillæa utilis* forms a very important and serviceable food to the poor in South America; and in this country, besides what are eaten by men and cattle, various Laminariæ are collected for kelp, along with the more usual kelpworts, which are chiefly contained in the following section.

(275.) FUCACEÆ. The *Tangs*, or sea-tangs, (Fucaceæ,) includ-

the plants under such circumstances, had enabled them to resist a degree of cold that would otherwise have destroyed them." Thus it is found that, not only the common sea-ware in its ordinary state, but even the refuse kelp, will form very valuable manure. "It appears," continues Dr. Greville, "from the communications made to the Highland Society, that the past success has been such, as to induce Lord Dundas to take a cargo of fifty tons of kelp to Yorkshire, for the sole purpose of agricultural experiments. It has been tried as a top-dressing, and singly, or in combination with other manures, on corn, pasture, potatoes, turnips, &c., with decided good effect. The committee appointed to collect the result of the experiments, are inclined to think that, for raising green crops, it would be better to compost it with other substances; that with good earth or moss, and a little vegetable or animal manure, a few tons of kelp would enable a farmer to extend his farm-dung over at least four times the usual quantity of land."

ing the black-wrack, or prickle-tang, (Fucus serratus) kelp-ware, or swine-tang, (Fucus vesiculosus), [vide § 51]; sea-whistles, or knob-tang, (Fucus nodosus), sea-oak, or knop-tang, (Halidrys); sea-thong, (Himanthalia), bladder-chain, (Cystoseira), with other allied genera, form, next to the *Floraceæ*, the most numerous type of the marine Algæ; and perhaps of all the most important and familiarly known.

Fucus, the normal genus, formerly included the whole of the known genera arranged in this section, as well as many that are now considered to belong to the Ulvaceæ and other types. Several of the genera, of which this is an example, were in truth rather *orders* than genera; and consequently, more accurate examination of the species, and intimate acquaintance with their habits and structure, has compelled their modern subdivision into many types; and although in this inquiry much has been lately done, much still remains to do. Of the fructification of the submarine flora, there is by far too little positively known to allow the characters of the types and sections to be generalized without various exceptions. On the whole, however, these are less both in number and importance, than the light which has so lately dawned on this field of study might have led many to expect.

(277.) The *Fucaceæ* are all marine plants, of an olive-brown or greenish colour, and of a very firm texture. In them the cellular structure is often much condensed, assuming a leathery, and sometimes a woody character; and so many fibres are developed (resembling slightly the Protonemata), along with the vesicles, that they tear with facility in a longitudinal direction, while most of the others rend irregularly: the base of the stipes forms a dense shield-like root, and the contrary extremity is often expanded into those foliaceous organs (pseudo-phylla) in which the cavities foreshadowed in the stems of Laminaria, and the leaves of Macrocystis become fully developed, and are named (*Pneumacysts*), or air-bladders. The fructification in these plants consists of small black, or very dark spores, with pellucid borders contained in distinct conceptacles collected into sori, which are either found indifferently on various parts of the frond, or, while some are barren, there are other peculiarly fertile branches.

(278.) "Fuci, with a few exceptions, do not inhabit very deep water, since, like other vegetables, they require light, and many of them also the occasional contact of air. A great part, therefore,

of the seeds they produce never germinate, for they are conveyed by currents, tides, and the reflux of the waves, into the bosom of the deep, and being never brought to shore again, they perish. It should hence be expected that nature would compensate for such destruction, by ordering the formation of spores in these plants to be very copious, and that such is the case one observation will prove. Mr. Turner was led to make a rough estimate of the number of seeds produced by a specimen of F. nodosus. "The specimen was small, being a little more than a foot long, and its fructifications were by no means numerous, yet on the most moderate computation the number of its seeds amounted 192,000."—*Drummond.* This plant sometimes grows to the length of six feet.

The gelatinous substance with which the spores of the Fuci and other sea-weeds are invested, seems to be a provision like the slime of the misletoe, and the threads of the Clutiæ, to fix them on the rocks against which they may be cast. And of the rapidity of their growth an interesting account has been placed on record by the same excellent naturalist, Mr. Neill, already so often referred to.

"A stone beacon was being erected on a low rock called the *Carr*, near the entrance of the Frith of Forth. This rock is about twenty feet broad and sixty feet long; and is only uncovered at the lowest ebb of spring-tides. It was at this time completely covered with the larger Algæ, especially Fucus esculentus and F. digitatus. By the necessary preparations for the beacon, these were all cleared off, and the rock reduced to a bare state by the beginning of November 1813, when it was obliged to be abandoned for the winter. The coating of sea-weed had at first been cut away by the workmen, the roots or bases afterwards trampled by their feet, and much of the surface of the rock had been chiseled. Upon returning to the Carr, in May 1814, in order to re-commence operations, it was matter of no slight surprise to find the surface again as completely invested with large sea-weeds as ever it was, although little more than six months had elapsed since the work had been left off, when, as already said, the rock had been cleared of weed. In particular, it was observed that many newly produced species of *F. esculentus*, measured *six feet* in length; and were already furnished with their fruit-bearing pinnæ. The common tangle, F. digitatus, was only about two feet long. It is to be observed, that the specimens here alluded to were taken from that part of the surface of the rock which had been dressed off with the pick or chisel the preceding autumn; they had therefore grown from the seed."

(279.) From the Himanthalia lorea (or sea-thong), Neill says, that a kind of sauce for fish somewhat resembling catsup, is made in the north of Scotland. The sea-thongs are said to be occa-

sionally found from ten to twenty feet in length; they make good kelp; but the F. vesiculosus is the more especial kelp-wort.

During the war, when barilla was subject to a very heavy duty, the kelp-manufacture was carried on to a great extent in the western islands and along the western shores of Scotland. At one time the kelp-shores in the island of North Uist were let for £7,000. a-year. It has been calculated that the quantity of kelp annually manufactured in the Hebrides only, exclusive of the mainland and of the Orkney and Shetland isles, amounted, at the period referred to, to about 6,000 tons a-year; and the total quantity made annually in Scotland and its adjacent isles, to about 20,000: which at some periods sold for £20. per ton; but the average price did not much exceed half that sum, viz. £10. 9*s*. 7*d*., calculating the price it sold for during twenty-three years ending with 1822.—*Ed. Encycl.* Since the reduction of the barilla duties and the repeal of the duty on salt, the kelp trade has fallen off rapidly, and perhaps will soon be entirely extinct.

(280.) In the manufacture of kelp, "the plants are cut from the rocks, or collected from the rejectamenta of the sea, and dried in the open air. An excavation like a grave is made in the ground, and lined with large stones, and in this, which is named a kelp-kiln, the dried weeds are burned, the fire being kept up by constantly throwing them on the flames. The melted alkali, mixed with many impurities, accumulates in the bottom of the kiln, and when cold, forms a hard bluish mass, which is named *kelp*, and is a substance of great importance in bleaching and in the manufacture of soap and glass. Almost the entire rent of the island of Rathlin, on the northern coast of Ireland, was thus paid from the produce of its sea-weeds. The smoke rising from the kelp-kilns on a fine calm day has a very picturesque effect, and during the night they suggest the idea of so many altars employed in nocturnal sacrifice."—*Drummond.*

Notwithstanding the manifest advantage of reaping harvests from the ocean, and selling the crops grown on otherwise barren rocks, for £6000 or £10,000 per annum, which has been done by single individuals, so strong were the prejudices formerly entertained against kelp-burning, that when first the manufacture was introduced, violence was resorted to by the peasantry to extinguish the kilns, and the kelp-burners were obliged to be protected by

the officers of justice. Actions were instituted, and several trials took place, the malcontents pleading—

"That the suffocating smoke that issued from the kelp-kilns would sicken or kill every species of fish on the coast, or drive them into the seas far beyond the reach of the fishermen; blast the corn and grass on their farms; introduce diseases of various kinds! and smite with barrenness their sheep, horses, and cattle, and even their own families." The proceedings exist (as Dr. Greville was informed by Mr. Peterkin) in the records of the sheriff's court: "a striking instance, as he observes, of the prejudice, indolence, and superstition of the simple people of Orkney in those days."

(281.) So important was the kelp trade some years since, that "where the plants did not grow naturally, attempts were made, and not wholly without success, to cultivate them by covering the sandy bays with large stones. By this method, Mr. Neill states, that a crop of fuci has been obtained in about three years, the sea appearing to abound everywhere with the necessary seeds."—*Grev.* As this cultivation has been so far successful, it would be important to endeavour to naturalize some valuable exotic species to our shores; and as aquatic are much more widely diffused than land plants, the temperature of the medium in which they live being so much more equable, the project might be attempted with every probability of success: among others, it would be most desirable to naturalize Gracillaria tenax and Laminaria buccinalis.

(282.) One species of Gracillaria, the compressa, which is indigenous to our seas, appears, says Dr. Greville, little inferior to the Gracillaria lichenöides, so highly valued for food in Ceylon, and other parts of the east; for Mrs. Griffiths tried it as a pickle and preserve, and in both ways found it excellent." The other species mentioned, the Gracillaria tenax, would, if naturalized, be as invaluable to us as to the Chinese, being the basis of an excellent glue and varnish. "Though a small plant, the quantity annually imported at Canton from the provinces of Fokein and Tche-kiang, is stated by Mr. Turner to be about 27,000lbs. It is sold for sixpence or eight pence per pound, and is used for the purposes to which we apply glue and gum arabic. The Chinese employ it chiefly in the manufacture of lanterns, to strengthen or varnish the paper, and sometimes to thicken or give a gloss to silks or gauze." In addition to the above account, the substance of which, says Dr. Greville, I have extracted from Mr. Turner's work, Mr.

Neill remarks, that it "seems probable that this is the principal ingredient in the celebrated gummy matter called Chin-chou or Hai-tsai, in China and Japan. Windows, made merely of slips of bamboo, crossed diagonally, have frequently their lozenge-shaped interstices wholly filled with the transparent glue of Hai-tsai."

(283.) The simple structures of the Algæ appear not to enable them to elaborate many of those proximate principles which characterize the more complex plants. They chiefly consist of mucilage and albumen, none of them are in their natural condition poisonous, nor any even suspected of being deleterious. It must however be recollected that iodine, when separated from the mucilage with which it is naturally combined, and taken in a concentrated form, becomes a poison. Their gelatinous substance is extremely nutritious, and, were it not for the large quantity of salt with which it is blended, would probably be more used as food. From the experiments of Sir Humphry Davy, it appears that the Fuci yield one eighth of their weight of jelly. But so greatly do these plants "abound in salt, that from five ounces of the ashes may be procured two ounces and a half of fixed alkaline salts, or half their weight. This circumstance has led to an economical application of them for the purpose of salting cheese; for in Jura, and some other of the Hebrides, the inhabitants dry their cheeses without salt, and supply its place by covering them with the ashes of sea-ware."—*Hooker*.

(284.) In Gothland the Fucus vesiculosus is given as provender to hogs, whence its name *swine-tang;* cattle also will feed on it in winter; and it is a curious fact, that in some of the Scottish isles, as the deer do in other places, "the cattle go regularly down to the shore at ebb-tide, and feed on this and various other sea-weeds; and it is observed that they know their time exactly, even when far away from the sea, and not within view of it."—*Drummond*.

(285.) The Fucus serratus or saw-wrack, is chiefly employed as packing for crabs and lobsters; our fishermen use both it and the F. vesiculosus indiscriminately, but the Dutch reject the latter, on account of the large quantity of mucus the vesicles contain, which soon ferments and becomes putrid, and select the former, which, however, contains much less salt, and is far less esteemed for kelp. In Jersey the F. vesiculosus is collected and dried for winter fuel; and Linnæus says, that in Scania the poor people do the same.

(286.) These plants, especially the F. vesiculosus, are used medicinally to form cataplasms in scrofulous diseases, and Dr. Russel recommends the mucus in the vesicles as an excellent resolvent; and, by calcining the plant in the open air, he made a very black salt powder, which he called *Æthiops vegetabilis*, a medicine that was once much used as a resolvent, and recommended also as an excellent dentifrice to correct the scorbutic laxity of the gums."—*Lightfoot.*

"But the chief medicinal properties of the fuci is now known to depend upon a substance called iodine, which they afford. This element exists in various species, but it is chiefly procured from the F. vesiculosus. According to the observations of Davy, the Kelp-ware of France yields more iodine than that of the British shores, and according to Ecklon, the Laminaria buccinalis of the Cape of Good Hope contains more than any European Algæ. To the iodine they contain, the efficacy of sea-weeds in scrofula, and of burnt sponge in goitre, is to be attributed; and it is, as Dr. Greville observes, a very curious fact, that the stems of a sea-weed are sold in the shops and chewed by the inhabitants of South America, wherever goitre is prevalent, for the same purpose. This remedy is termed by them Palo Coto, (literally goitre-stick;) and, from fragments brought by Dr. Gillies, who gave Dr. Greville this information, the plant is decided to belong to the type *Laminaceæ*, and is probably a species of *Laminaria*."

(287.) Iodine is certainly one of the most important of the remedial means added to the materia medica in modern times; subjecting, as it often does, some of the most intractable diseases to the dominion of art. [See § 51.]

(288.) The *Sargassum vulgare*, the tropic grape of sailors, and the Fucus natans of the older writers, is worthy attention, not only from its wandering habits, quitting as it does the submarine soil to which it probably in its early stages is attached, but also for the astounding profusion in which it so frequently is found. It only grows within forty degrees of latitude on either side of the equator, but currents often cast it on our coast. It is a remarkable circumstance in the history of this plant, that it is chiefly local in its position, even when detached, forming two great banks, one of which is usually crossed by vessels homeward-bound from Monte Video, or the Cape of Good Hope; and so constant are they in their places, that they assist the Spanish pilots to rectify their

longitude. It is probable that these banks were known to the Phœnicians, who, in thirty days' sail with an easterly wind, came into what they called the "Weedy Sea;" and to the present day, by the Spaniards and Portuguese, the chief tract is named *Mar de Zargasso*. It was the entering of such fields of fucus as these that struck so much terror into the minds of the first discoverers of America; for, sailing tardily through extensive meadows for days together, the sailors of Columbus superstitiously believed that the hindrance was designed by heaven to stay their adventurous course: hence they wildly urged their commander to proceed no further, declaring that through the bands thus woven by nature it would be presumptuous impiety to force a way.

(289.) Lichinaceæ. *Lichina* (or the *Lichen-flag*), usually included amongst the *Fucaceæ*, forms the transition from the *Fucinæ* to the *Lichens*, the succeeding order. It is, however, a plant so different from the true Fucaceæ, that it has been thought advisable by Greville (an opinion which circumstances fully bear out), to

Lichina confinis et pygmæa.

(*a*) Shoot of L. confinis. (*b*) L. pygmæa. (*c*) Ditto magnified. (*d*) Conceptacle of ditto. (*e*) Transverse section of same. (*f*) Spores. (*g*) Old conceptacle, collapsed and assuming a lichenoid appearance.

make of it a distinct type. Its characters will of course be the same as those of the single genus it at present contains.

(290.) The *Lichinaceæ* will be therefore known by their fibro-cartilaginous structure, their dingy green hue changing to black on exposure to the air, and their conceptacles furnished each with a pore. These conceptacles are filled by a colourless gelatinous mass of very fine filaments, among which pellucid oval or oblong

spores are disposed, in many radiating moniliform series. The conceptacles, when their contents have been discharged, collapse, and " at length resemble the old shields of a Lichen."

(291.) Thus the *Lichinaceæ* connect the *Fucales* by an easy transition to the following order, the *Lichenales*. The present name *Lichina*, as well as the older one Fucus *Lichenöides*, are evidences that the double similitude has been at all times perceived, and generally acknowledged. One species, indeed, the *Lichina confinis*, was formerly included by Acharius among his Lichens; its affinity with the fuci, and its situation on the confines of the two orders being indicated by its specific name.

(292.) These plants have, as Hooker observes, very much the habit, though not the structure of stereocaulon, amongst the Lichens, to which genus it was that Acharius referred them.

(293.) Two species only are known of the single genus which forms this type, and both are natives of Britain. They grow on rocks which are never permanently submerged; Lichina pygmæa on such as are much exposed to the air and almost dry at low water, Lichina confinis on others which are often left dry, and are only covered at high tides; so that it is a still less aquatic plant, and approaches still nearer to the habits of the Lichens.

(294.) The types *Lichinaceæ*, *Fucaceæ*, *Laminaceæ*, *Sporochnaceæ*, *Chordariaceæ*, and *Dictyotaceæ*, form collectively the section called, from Fucus, the most important genus, and the one in which they all were once included, the Fucinæ; and the Fucinæ, when associated with the Florinæ and Ulvinæ, constitute, as before observed [§ 261,] the order *Phycæ*, or rather Fucales; the distribution of which, when reduced to a tabular form, will be as follows:

Order.	Sections.	Types.
Fucales Phycæ	Fucinæ	Lichinaceæ.
		Fucaceæ.
		Laminaceæ.
		Sporochnaceæ.
		Chordariaceæ.
		Dictyotaceæ.
	Florinæ	Furcellaceæ.
		Spongiocarpaceæ.
		Floraceæ.
		Thaumasiaceæ.
		Gastrocarpaceæ.
		Caulerpaceæ.
	Ulvinæ	Lemaniaceæ.
		Ulvaceæ.
		Siphonaceæ.

GEOGRAPHICAL DISTRIBUTION OF THE FUCALES.

(295.) The geographical distribution of the Fucales is most extensive, some representative of the order being found in every latitude; the facility of transport and the more equable temperature of the medium in which they live may, in part, account for their omnipresence. The marine *Algæ*, those commonly known as *sea-weeds*, have however, as might be expected, a wider range than the *river-wracks*, or the *fresh-water ulvæ*.

(296.) Still, though the order is present by some of its species in all quarters of the globe, the stations of many of the types and genera are extremely confined; and, notwithstanding the ease of transit, some are absolutely local.

(297.) But a very short time since it was affirmed, on the then best and highest authority, that "plants which grow at the bottom of the sea are found in all regions, because the vicissitudes of heat and cold are never felt at such depths, the water being generally everywhere of the same temperature."

Yet even then it was known, that although some sea-plants are found "everywhere," "as well under the equator as under the poles," others are more local, especially such as prefer shallow waters; and these were supposed to be the only ones upon which climate had any influence. It had also been long remarked, that the heights of submarine hills are more productive than the deep gulfs and valleys of the ocean.

(298.) Such, until the present day, was nearly the sum of all that was known concerning the geographical distribution of the oceanic flora. Modern research has however given an unthought-of importance and an entirely new aspect to this branch of botany, which, as a science, may justly be claimed as the achievement of our age.

(299.) *Lamouroux*, *Bory St. Vincent*, and others, have already shewn that botanical regions exist, and that their boundaries may be traced, by peculiar vegetations in the sea as well as upon the land. Detailed accounts of their labours have been published in the Annales des Sciences Naturelles, (vol. vii. p. 60.), and in the botanical part of Duperry's Voyage round the World. Admirable sketches of their labours will also be found in "Brongniart's History of Fossil Vegetables," and in the Introduction to "Greville's

British Algæ." From these works the materials of the following condensed conspectus have been chiefly drawn.

(300.) Two contrary schemes may be pursued in the prosecution of phyto-geographical researches. Either the several zones may be examined as to the number and proportion of the types, genera, and species, existing or predominating in each, or the range of the several sections and other subordinate groups of the *Fucales*, or any other order, may be traced, and their respective stations noted. The first scheme which gives an account of the marine flora of any known and determined region is called vegetable statistics; the other, which affords an insight into the distribution of known and determined plants, is named vegetable topography. The former was neglected until the present day. The latter has long been more or less pursued, and records of habitats and stations kept in most systematic works with varying exactness.

Both these views should in turn be taken; for it is of manifest advantage to know, not only the vegetation of a certain district, but also all the zones and regions in which the same or similar plants are found.

(301.) The simplest division of the surface of the globe, and one that is quite sufficient for the first stage of the present enquiry, is into five zones, the two frigid, the two temperate, and the torrid: called the arctic, the antarctic, the north and south temperate, and the equatorial zones.

Geographers affirm that "every great zone presents a peculiar system of existence; and it is said that, after a space of twenty-four degrees of latitude, a nearly total change is observed in the species of organized beings, and that this change is mainly owing to the influence of temperature. Lamouroux remarks, that if this holds good, as we know it to do to a wonderful extent in phænogamous plants, it should also exert some corresponding force upon marine vegetation." And this it certainly does; for as Greville continues, "It is unquestionable that the *Algæ* are found on our own coasts in the greatest abundance during the summer months, and in unusual luxuriance in hot seasons. It is probable also, observes Lamouroux, that these plants may be acted on by the temperature of the water at greater or less depths, and that the species which grow at the bottom of the ocean may have some resemblance to those of the polar circle. On the shores of the British islands it is easy to perceive that some species, *Gelidium corneum*, *Phyllophora rubens*, and *Sphærococcus coronopifolius*, for example, become more plentiful and luxuriant as we travel from north to south; and, on the other hand, that *Ptilota plumosa*, *Rhodomela lycopodioides*, *Rhodomenia sobolifera*, and several others, occur more frequently, and in a finer state, as we approach the north. *Odonthalia dentata* and *Rhodomenia cristata*, are confined

to the northern parts of Great Britain, while the *Cystoseiræ*, *Fucus tuberculatus*, *Haliseris polypodiöides*, *Rhodomenia jubata*, *R. Teedii*, *Microcladia glandulosa*, *Rhodomela pinastroides*, *Laurencia tenuissima*, *Iridæa reniformis*, and many others, are confined to the southern parts. Others again, such as the *Fuci* in general, the *Laminaceæ*, many *Delesseriæ*, some Nitophyllæ, Laurentiæ, Gastridia, and Chondri, possess too extended a range to be influenced by the change of temperature, between the northern boundary of Scotland and the south-western point of England." Researches and calculations on a much more ample scale have, however, shewn that "the great groups of Algæ do affect particular temperatures or zones of latitude, though some genera may be termed cosmopolite."

Thus the *Siphoneæ*, or at least the genus Codium and the Ulvaceæ, continues Greville, are scattered all over the world. Other types are, however, peculiar to the several great zones, and even many subordinate regions have each a characteristic vegetation.

(302.) Lamouroux states that the seas of the northern polar circle are the favorite habitats of immense *Laminaceæ;* these plants being much more abundant in the cold, though not absent from the temperate zones. The Fucaceæ are also found in vast numbers on the coasts of the same seas. A few of the Floraceæ are met with in similar situations, but much less frequently than in more temperate latitudes, where they are exuberant in the extreme. Lastly, that the *Ulvaceæ*, which are very widely spread, abound more in these parts than in any others. The circumpolar vegetation appears to be identical, or nearly so, both in the North Atlantic Ocean and in Behring's Straits.

(303.) In the South polar seas, on the shores of Van Diemen's land, and at the extreme point of the great continent of South America, the *Laminaceæ*, which are not met with in the tropical regions, re-appear in profusion. Here also are found several *Fuci*, shewing a further likeness in the vegetations of the arctic and the antarctic zones. *Durvillea* and *Lessonia*, formerly mentioned, [§ 274, 275], and the remarkable genus *Macrocystis*, all of which are *Laminaceæ*, seem to be peculiar to the Australian seas; the latter, however, exists only from the equator to the forty-fifth degree of south latitude: it is therefore characteristic rather of the southern hemisphere than of either of its zones.

(304.) In the temperate oceanic regions of Europe, the Fucaceæ, especially the *Fuci*, predominate, (one species, F. serratus, is entirely confined to Europe;) and where the Fuci become less common, some species of the allied genus Cystoseira take their place.

The latter are found between the fiftieth and twenty-fifth degree of latitude, while the former in general flourish only from the fifty-fifth to the forty-fourth degree, rarely being seen nearer to the equator than the thirty-sixth degree.

(305.) Bryopsis and the various species of Ulva, occur likewise in abundance, adding another feature to the characteristic vegetation of this zone; which, with the great predominance of the *Floraceæ* over the *Laminaceæ*, will sufficiently distinguish it from that of the Northern seas.

(306.) Of the vegetation of the south temperate zone, the information afforded is less precise. The *Floraceæ*, which, when abundant, are characteristic of the temperate regions, are less numerous in the southern than in the northern seas; "a fact that, Lamouroux thinks, may be accounted for from the inferior extent of the temperate zone in that hemisphere."

"In New Holland, remarkable alike for its vegetation and animal productions, a distinct group of Cystoseiræ predominates, as singular in the water as the Aphyllous Acaciæ are on the land. Their stems are compressed, often appearing to be jointed; the branches springing from the flat side and not from the angles, and are deflexed at their insertion, besides which, their vesicles are solitary and pedicellate."—*Grev.*

(307.) In the equatorial regions, new and very different plants are found, which come in hosts to characterize the equinoctial zone. Amongst the FUCACEÆ, *Sargassum*, or the tropic grape, commonly known as the sea-grass, or *gulf-weed*, supersedes the true Fuci. Immense masses of it, resembling islands, are constantly met with between the tropics, [§ 288] and examples rarely occur beyond the forty-second degree in either hemisphere.

(308.) The Red Sea is also full of Sargassa, whence, indeed, some persons think it has received its name. *Hypnea*, *Acanthophora*, Tamnophora, Amansia, and the delicate *Gelidium*, of which the eatable swallow's nests are made, are peculiar to this region. *Caulerpa*, also, is only found in the equatorial zone, or on the shores of the southern temperate region of New Holland.

(309.) Thus, although some types and genera are widely spread, there is found to be a vegetation peculiar to, and characteristic of, each great zone. Of these, the most notorious forms are easily recognisable. The *Laminariæ*, and the true *Fuci*, are distinctive of the cold and temperate zones: while Sargassum, Tamnophora, &c., are as rarely found excepting within the tropics. The first

named are consequently indicators of a cold, the last of a sultry clime.

(310.) Besides the general features characteristic of these great zones, which have been made out satisfactorily in their main points by Lamouroux, Bory St. Vincent has endeavoured to trace the differences of marine vegetation in subordinate oceanic regions, similar to the geographical regions of terrestrial plants.

For not only does "the polar atlantic basin to the fortieth degree of north latitude present a well marked vegetation, but the same may be said of the West Indian sea, including the Gulf of Mexico, of the eastern coast of South America, of the Indian ocean and its gulfs, and of the shores of New Holland and the neighbouring islands. The Mediterranean possesses a vegetation peculiar to itself, extending as far as the Black Sea; and, notwithstanding the geographical proximity of the port of Alexandria and the coasts of Syria to those of Suez and the Red Sea, the marine plants of the former, in regard to species, differ almost entirely from those of the latter. Bory St. Vincent characterizes each of his Mediterranean seas by a vegetation different from that of the Arctic, Atlantic, Antarctic, Indian and Pacific Oceans; and to a certain extent, (says Greville,) he is probably correct, as such seas are of less depth, often of a higher temperature, and more directly influenced by the countries which more or less surround them. The seas which he considers Mediterranean are, besides the Mediterranean commonly so called, the Baltic Sea, the Red Sea, the Persian Gulf, the Chinese Sea, the seas of Ochotsk and Behring, and the West Indian Sea, along with the Gulf of Mexico, denominated by him the Columbian Mediterranean."

(311.) The topographical range of the several groups of the *Fucales* has been already in part given when trèating of the individual types and sections; little, therefore, on this point, now remains to be done, but to generalize the distribution of the large groups; the smaller types do not afford sufficient materials for generalization.

(312.) Lamouroux states it as his belief, that about 1600 species of Fucales are known, and have been collected and preserved in herbaria; he further calculates, though not on unexceptionable data, that between 5000 and 6000 exist in the various regions he points out. Our present knowledge of these plants must be, therefore, if his calculations approach the truth, very rudimentary and imperfect, for not many more than 500 species have as yet been fully described and absolutely determined to belong to the order. [§ 294.]

These have been associated to form three sections and fifteen types.

(313.) Greville observes, in his *Algologia*, when treating on this

subject, that "it is very clear and well known to the practical botanist, that marine plants are much influenced by the nature of the soil, not merely in regard to species, but in luxuriance and rapidity of development. A few yards is, in some instances, sufficient to create a change; and the space of three or four miles, a very striking one. Thus, calcareous rock favors the production of some species; sandstone and basalt that of others; and it would appear that soil has an effect even upon those algæ which grow parasitically upon larger species. But, sometimes, to all appearance independent of this cause, peculiar forms predominate in certain localities, both in regard to genera and species, which, as we approach their boundaries, gradually disappear, and often give place to others equally characteristic."

(314.) The very confined range of such plants gives the account of their distribution, a topographical, rather than a geographical, aspect. Others, however, though more widely spread, have been shewn to affect peculiar regions, and only to abound in certain latitudes; while others, again, are scattered over every part of the world.

(315.) "Amongst the *Siphonaceæ*, *Codium tomentosum* is found in the Atlantic, from the shores of England and Scotland to the Cape of Good Hope; in the Pacific, from Nootka Sound to the southern coast of New Holland. It abounds also in the Mediterranean, on the shores of France, Spain, and Africa, and is common in the Adriatic. It has, likewise, been recently brought from the coasts of Chili and Peru. This plant, however, is not a social one; it grows even in the same locality, in a solitary and scattered manner. The *Ulvaceæ*, on the contrary, are strictly social, and preserve this character in every part of the world. They appear, however, to attain to greatest perfection in the polar and temperate zones, although very fine Porphyræ have been brought from the Cape of Good Hope; and that they are capable of sustaining severe cold is proved by the fact, that fine specimens of Enteromorpha compressa, [§ 241], were picked up in high latitudes by some of the gentlemen who accompanied Captain Parry in his second voyage of discovery."—*Greville.*

(316.) Of the Lemaniaceæ, Furcellaceæ, Chordariaceæ, Lichinaceæ, Spongiocarpaceæ, Gastrocarpaceæ, Caulerpaceæ, and Thaumasiaceæ, several of which types consist of single genera, it may suffice to repeat that Lemania is the only fresh-water genus known; it inhabits mountain-torrents and impetuous streams in

the temperate regions both of Europe and North America. The Gastrocarpaceæ are indigenous to the temperate zone; Furcellaria, Chordaria, and Lichina, are also found upon our shores; and the Spongiocarpaceæ, both in the British seas and in those of Chili and New Holland. Caulerpa is confined to the southern hemisphere; and the extraordinary Thaumasia is a native of Ceylon.

It is evident, even from this brief recapitulation, that some of these plants have an extensive range, and that others, as far as we know, are extremely local; but, at present, too little information has been obtained to allow of further generalization.

(317.) The small groups being thus summarily disposed of, the four extensive types, *Floraceæ*, *Dictyotaceæ*, *Laminaceæ*, and *Fucaceæ*, are the only other ones remaining: and of their distribution, which is the most important, much more is known.

(318.) The *Dictyotaceæ* are rather tropical than European plants; for, although eight are found on the Scottish, and thirteen species on the English shores, they gradually and greatly increase, both in quantity and variety, in the seas nearer the equator.

(319.) The numerous genera and species of the very large type *Floraceæ*, are chiefly predominant in the north and south temperate zones. There are, however, various exceptions to this general rule. *Hypnea* and *Acanthophora* approach the type to the equatorial regions; and *Amansia* is exclusively found within the tropics.

(320.) "The *Laminaceæ*, among which are the giants of the marine flora, exhibit, in a broad view, a tolerably decided geographical distribution. The *Laminariæ* predominate from the fortieth to the sixty-fifth degree of latitude; while the Macrocystes seem, as far as we know, to exist from the equator to about the forty-fifth degree of south latitude."

(321.) The *Fucaceæ*, and particularly the *Fuci*, are the especial sea-weeds of the temperate zones; being found in those latitudes, both in the northern and southern hemispheres, although they are absent from the intermediate equatorial regions. The *Sargassum*, or tropic grape, which has been already mentioned as being so abundant between the twenty-fifth and thirty-sixth degree of north latitude, may seem a serious objection to the above statement; but the Sargassa, although produced within the tropics, grow, there is little doubt, at very considerable depths, so that the temperature of their habitats is less than that of the surface of the ocean in the equatorial zone.

"In the genus Sargassum there is also observed a small group as local, and almost as peculiar, as that just mentioned of the Cystoseiræ. It occurs in the seas of China and Japan, and consists of Sargassum fulvellum, microceratium, macrocarpum, sisymbriöides, Horneri, pallidum, and hemiphyllum, distinguished from the rest by their terminal fructification, a slender habit, small nerveless leaves, and often elongated vesicles."—*Grev.*

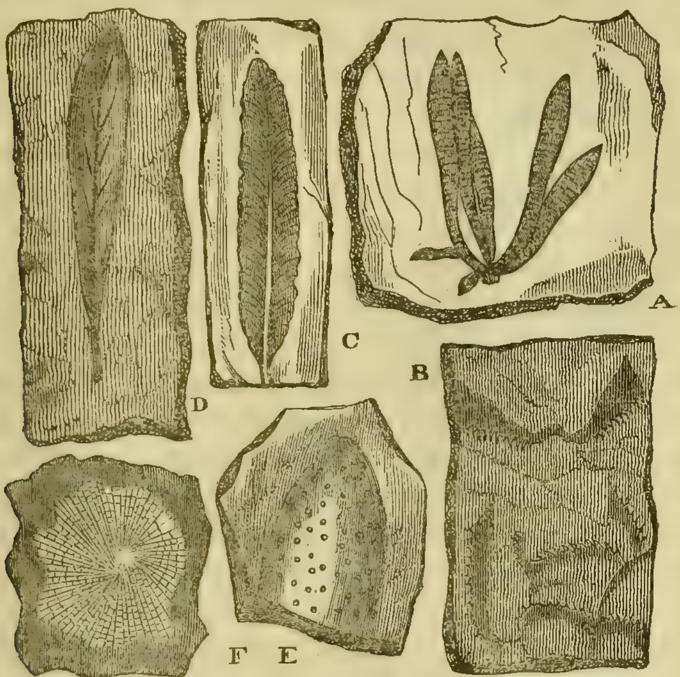
GEOLOGICAL DISTRIBUTION OF THE FUCALES.

(322.) The chief difference observable in the geographical distribution of the two preceding orders is, that the *Confervales* are peculiarly the inhabitants of cold and temperate regions, very few being found either in warm springs or in the equatorial zone; while the *Fucales* are the most abundant within the tropics, and extend from the equator to the poles. Does the geological distribution of these latter plants confirm the general views which have been taken of the geographical range of the present existing species in as striking a manner as it has been found to do with respect to the *Confervales?* [§219, et seq.] Do the facts presented by one of these twin-branches of natural science strengthen or refute the conclusions arrived at by the other?

(323.) As was the case with the *Confervales*, the whole of the fossil inarticulated algæ are included in a single group, or genus; of which, according to Brongniart, the following are further distinctive characters: "Continuous fronds, usually irregular, neither symmetrical, nor subcylindrical; sometimes simple, but more frequently branched, occasionally naked, but more often leafy; either membranous, entire, or more or less lobed, with no ribs, or imperfectly marked ones, the markings being irregular, and never anastomosing.

(324.) Although Brongniart associates all the fossil remains of the Fuci in a single genus, which he calls *Fucöides*, he has subdivided the group into several sections, or subgenera, which will probably hereafter be esteemed genera, and the present genus a fossil order. These subgenera are known by the termination *ites*, instead of *öides*, being suffixed to the name of the modern genus, to which they seem severally to be most nearly allied. Thus *Fucöides septentrionalis* is called *Sargassites; Fucöides strictus, Fucites; Fucöides tuberculosus, Laminarites;* and so on of the rest.

(325.) Among the fossil remains of ancient plants which, from their resemblance to the Fucales, have been named *Fucöides*, about six and thirty species have been discovered, and satisfactorily determined to belong to the present order.



A. Fucöides encœliöides. E. Ditto, apex of frond magnified. B. Fucöides serra. C. Fucöides Agardhianus. D. Fucöides Bertrandi. F. Ditto, portion magnified.

Of these, *four* species occur in the transition rocks, *seven* in the bituminous strata, *three* in the oolitic series, *eleven* in the chalk, and as many in the London clay formation. Thus, instead of being confined, like the Confervales, to the upper deposits of the secondary and tertiary groups, the Fucales are found in some of the most ancient strata of our globe.* Geographically ranging through every latitude; geologically spread through almost every epoch; unmindful of temperature now, they seem to have been able, in like manner formerly, to endure heats, which their weaker brethren, the Confervæ, could not withstand.

(326.) The fossil species found in the transition rocks are, 1st. the *F. antiquus*, discovered in the neighbourhood of Christiana.

* See Brongniart's History of Fossil Vegetables, page 412, et seq.; and Lindley and Hutton's Fossil Flora of Great Britain, Part iv.

2dly, *F. circinatus*, from the transition rocks at the foot of the Kinnekulle, in West Gothland. 3dly, *F. dentatus*. And, 4thly, *F. Serra*. Both these last named occur in the transition limestone of Canada.

(327.) No very striking resemblance has hitherto been traced between either of the two first-named fossils and any existing fuci. The former, however, Brongniart states to be more like a Sphærococcus than any other known genus. The *Fucöides dentatus* and *Serra*, [§ 325, B.], he observes, "although very different from any flags now actually in existence, appear to approach the nearest to *Amansia*, an exclusively tropical genus."

(328.) The seven found in the bituminous shale are *Fucöides septentrionalis*, *F. Nilsonianus*, *F. lycopodiöides*. *F. selaginöides*, *F. frumentarius*, *F. pectinatus*, and *F. digitatus*.

The first of the above, according to the opinion of Agardh, who has examined it in a favorable condition, is a *Sargassum*. The four next appear to belong to the genus *Caulerpa*. Of the affinities of the two last, it is difficult to form even a probable guess. Thus, of seven species, five belong, according to all appearances, to two genera, which are peculiarly characteristic of the marine vegetation of the equatorial zone.

(329.) In the vast series which separate the lower strata of the mountain limestone from the chalk, there are found scarcely any traces of sea-plants. The oolites, in their most comprehensive sense, contain but three, *F. Stockii*, *encœliöides*, [§ 325, A.], and *furcatus;* and their resemblances are chiefly to such living plants as are not characteristic of any particular regions.

(330.) The remains of fossil Fuci become more frequent in the strata which separate the Jura limestone from the chalk; and some remarkable species are found in these formations. *F. Targionii*, *æqualis*, *difformis*, and *intricatus*, have a common character, which shews them to belong to the same genus: a genus which approaches to *Chondria*, or *Sphærococcus* of Agardh; or rather to *Laurencia*, or *Gelidium* of Lamouroux; genera which, although not peculiar to any one zone, are much more frequent in the tropical and temperate than in the northern regions.

F. Brardii, *orbignianus*, *strictus*, and *tuberculosus*, which are found in the isle of Aix, are still more remark-worthy; for of these four, the two last present an organization which separates them very widely from all existing species; while the nearest

approach of the two former seems to be to *Caulerpa*, a genus, as already observed, that is peculiarly tropical. These plants, therefore, indicate a former submarine vegetation very different from what is now seen upon our coasts, and approaching rather to that of the equatorial region than of the polar zones.

(331.) Although the whole preceding ten species are found, in the strata called collectively the chalk formation, only one fossil flag has been discovered in the chalk itself; and that is the *F. Lyngbyanus.* This fossil also resembles *Caulerpa.*

(332.) If the fossil Fuci of the tertiary formations be now examined, a different result will be obtained. The most important of these are, the *Fucoides Sternbergii*, *Agardhianus* [§ 325, C.] *spathulatus*, *Lamourouxii*, *Bertrandi* [§ 325, D, F.] *obtusus*, *flabellaris*, *multifidus*, and several others. The two first named have a doubtful resemblance to *Sargassum* and *Caulerpa*; all the remaining ones to Algæ, which in the present day are indigenous to European seas, such as *Delesseria*, *Chondria*, and *Dictyota.* The resemblance, indeed, of these fossils is so strong with the three recent genera above-named, as to render it, for example, impossible to find any specific distinction between *Fucöides obtusus*, and *Chondria* (*Laurencia*) *obtusa* of our shores.

(333.) Thus the geological distribution of the *Fucales*, like that of the *Confervales*, fully corroborates the general views arrived at of their geographical range. Those fossils which occur in the upper or most recent strata of the earth, most nearly resemble the vegetation of our zone; while those, which are found in the more ancient formations, bear a greater similitude to the marine flora of the tropics; and lastly, the few remains which have been discovered in the transition series depart the farthest of all from the present oceanic vegetation of any region, some being wholly unlike every plant now known.

(334.) This gradual recession from tropical forms, as the series gradually recedes from the most ancient sedimentary deposits; and the progressive approach nearer and nearer to the present existing vegetation, and even to the aquatic plants of European countries, as the strata are of later and later formation, appears to indicate that there has been a gradual diminution of the temperature of the surface of our globe. But still as decided *Fuci*, and some of them bearing a resemblance to the tropical species of our own times, existed even in the transition epoch, and as the resemblances be-

come stronger and more numerous amongst those remains which abound in the bituminous shale, to say nothing of the doubtful Ulvinæ, [§ 220], it is not probable that the variation has been so extreme as many persons, on what would thus appear to be insufficient data, have been disposed to believe. The evidence, although decided as to the former higher range of temperature, does not, so far as it hitherto has gone, even warrant the suspicion that equatorial heats were ever felt in the frigid zones ; notwithstanding proofs are abundant that the temperature of the tropics once extended much further, than now, towards the poles.

(335.) In addition to the evidence offered by these plants of the former temperature of the globe, evidence which is fully borne out by the distribution of the Confervales, and which will receive further confirmation from the fossil remains of other natural groups, something may perhaps be learned of the physical condition of the earth, as respects the proportions which land and water held to each other in the remote eras now under consideration.

(336.) As no traces of land plants occur in any of those early strata in which the *Fucöides* are found; and more especially as not any remains of *fresh*-water *Ulvinæ* have been discovered, it is not unreasonable to suppose, that Fuci flourished before the waters were gathered together into one place, and before the dry land appeared. This will account for the non-existence, in this epoch, of the Confervales; so many of which are fresh-water plants: and whose chief duties are confined to streams and lakes, while the Fuci "occupy their business in great waters."

(337.) It likewise will not have escaped the attentive reader that *Confervites fasciculata* resembles Conferva ærea, a salt-water species, more closely than it does any other existing species; that Confervites(?) ægagropiloides is likened to the *oceanic*, not to the *moor*, balls; and, that the other fragments of Confervites, examined by Brongniart, are compared to the various genera of the type Ceramiaceæ, a group that is exclusively marine: nor is it, until arrived at the tertiary formations, that a fresh-water Confervites has been recognized in the solitary instance of C. Thoreæformis; which, be it observed, shews its chief affinity to be with *Thorea violacea*, one of the few known existing species of tropical Confervæ.

LICHENALES.

(338.) The *Lichens*,* or *Aërial Flags*, the third and last order in this class, have been by some botanists considered as of inferior rank to all the other Algæ. But although they are often less in size, and although the simplest of the Time-stains are much more simple in their structure than the *Fucinæ*, they do not appear to yield to the simpler sections of the *Confervales;* and this more

A. Opegrapha minuta. (*a*) Group of plants. (*b, c, d, e,*) Sections of lirellæ, or lirelliform thalli. B. Opegrapha rugulosa. (*a, b, c*) Lirellæ detached. D. Graphis scripta. (*a*) Natural size. (*b*) Portion magnified. E. Stereocaulon salazianum. F. Ditto Apothecia, magnified. G. Ditto, Vertical section shewing the lamina proligera. H. Sphærophoron fragile. I. Ditto, magnified. J. Section of Apothecium. K. Bæomyces roseus. L. Apothecium magnified. M. Section of ditto. N. Gyrophora cylindrica. O, P, Q, R, S. Apothecia in the form of Cephalodia, with podetia. T. Gassicurtia coccinea. V, V, W. Ditto, magnified.

especially as in the Lichens and their allies, although the thallus is often less evolved, the spores are generally with more certainty developed. For as in the aquatic types, their moist localities favour a luxuriant growth of the organs of vegetation; so in the aerial order, the sun and air which tend, in arid places, to contract the thallus, favour the evolution of the fruit.

* Lichenes, Lichenales, or Lichenosæ, of various systematic writers.

(339.) The question of precedence, however, is not here attempted to be settled, nor is it indeed a point of paramount importance. In a strictly natural scheme, perhaps, the simplest sections of the aquatic and the aerial algæ, with the simplest sections of the three orders contained in the next class, Fungi should all be placed in proximity and treated of, as far as possible, together; for they all either set out from nearly similar simple forms, or else return to them; although the progress of their several developments takes place in very different courses: was rank, therefore, a matter of prime consideration, they should all be simultaneously described; but as such a plan could only lead to confusion, some gradation must be established, and that which is here adopted has several advantages to recommend it. For having, as it were, risen from the *Globulinaceæ* and *Siphonaceæ*, to the *Ceramiaceæ* and *Lichinaceæ* of the two preceding orders, the course proposed for pursuit will be, to descend in this from the moss-like* and flag-like Lichens,† through the mould-like lichens,‡ to the true moulds and mushrooms, or Fungi. In one order of which class, the lowest section of the *time-stains*, now associated with the other *Lichenales*, will be found even in the present day to be by most botanists included. While, on the other hand, *Lichina*, which forms the normal genus of our type Lichinaceæ, and which, being on the confines of the *Fucales*, is regarded as the transitional stage from the Fucinæ to the Lichens, has by some very able Algologists been referred to the lichens. Its aquatic habit and general characters, however, rather persuade to its retention among the Fucinæ. Still the links which it and the Myco-Lichenes, or Byssinæ, form, should be always kept in mind.

(340.) From these two points, therefore, the ascending and descending scales respectively commence. Here both shall be developed, for, after tracing in an upward course the several chief gradations of structure in the Lichens and their allies, as their evolution is supposed to be *regressive*, a return shall be made, in the practical demonstrations, from the confines of the *Fucinæ* to the *Fungi*.

(341.) This is, indeed, the course which a Lichenologist of great celebrity supposes that nature may have pursued in the formation

* *Bryo-Lichenes*, vel *Cetrarinæ*, (§ 363.)

† *Phyco-Lichenes*, vel *Verrucarinæ*, (§ 338, E, F, H, &c.)

‡ *Myco-Lichenes*, vel *Byssinæ*, (§ 338, N, O, P.)

of these plants; the Phycæ, or Fucales, being considered as the primogenitæ, and flourishing when the water covered the face of the earth. As the rocks and dry land appeared, these would give way to progressively more and more terrestrial series, such as the Lichinaceæ that are only occasionally submerged, and these would in their turn be followed by exclusively aerial species. Thus the Lichens are considered as a regressive group, in which the thallus becomes contracted; and Fungi a lower still, which, as they are parasitic on matter that has been once alive, must of necessity succeed the production of the substances on which they grow.

(342.) Analogous to the phycomater of the aquatic Algæ, a rudimental matrix precedes the development of their more characteristic organs in the aerial flags. Under certain circumstances this thallus remains permanently in its primordial state, without any further evolution taking place. Some Lichens are peculiarly prone to such abortions, which are known as their barren forms; while in others, especially such as grow in dark damp places, the thallus cannot easily be recognized as the matrix of any especial Lichen.

(343.) When the absence of fructification was esteemed a valid generic sign, many of these degenerate plants were grouped together, and from the leprous aspect which they give to the substances on which they grow, they were denominated *Lepræ*, or *Leprariæ*, [§ 390, fig. G, H, I. J.] In systematic catalogues several species will be found, named, and distinguished according to their colours, as the yellow, the green, and the tawney L. flava, chlorina, sulphurea, ochroleuca, &c. &c. It is, indeed, from the general scurvy appearance of these plants, that they are collectively denominated Lichens, (from λειχην.)

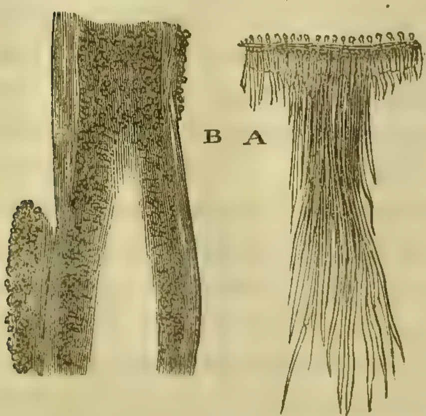
(344.) The thallus, which thus, as it were, constitutes the essence of a Lichen, and which is alone developed in the leprarious stage, assumes, in the superior grades, according to the varied force and predominance of the centripetal and centrifugal evolutions, very various forms. Sometimes it is extended into lines, when it is called *vertical*, [§ 364, A, B, C;] at others expanded, when it is called horizontal [§ 390, A.] The vertical thalli are either erect, as in Cladonia, [§ 380,] or pendent, as in Usnea [§ 364;] and either simple, or much divided, when they are called *Lorula*, [§ 338, fig. E, § 364, A, B.]

The horizontal thalli are very various likewise; but to their

variations no especial names of note are given, further than that, according to their substance, they are said to be either foliaceous, subfoliaceous, [§ 364, C, D, E,] or when brittle, *crustaceous*, [§ 384.]

(345.) As in some Lichens, the thallus is alone developed; and in others it is predominantly evolved; so in those which verge towards the Fungi, the thallus becomes less evident, and in some is so obscure, as to be thought to be absent, *e. g.* the Opegraphas Verrucarias, &c. and as also in *Endocarpon athallum.*

(346.) The thallus in Lepraria, and the lower Lichens, as in the lower submerged algæ, consists of cellular structure, uncondensed, and not collected into any strata; but in the subsequent gradations, the thallus is found to be more or less evidently stratified, and the strata receive distinctive names; the under layer being



A. Epithallus and Mesothallus, Hypothallus wanting.

B. Epithallus, Mesothallus, and Hypothallus, all present, with fruit forming on the Epithallus.

called the hypothallus, and the upper the epithallus, while the intermediate portion is the mesothallus. These are the modern names given to the cortical and medullary substances of the older writers.

(347.) In some Lichens these several strata are all discrete, as in the *Parmelidæ;* while, in others, either may be absent or obscure; thus, in the *Usnidæ*, there is no hypothallus, while, in the *Byssaceæ*, the epithallus is wanting. Indeed, the whole section *Byssinæ* remains in what Fries terms the hypothalline state, [§ 390, G, H.] the cortical and medullary substances being blended together; the whole fabric is also either gelatinous or filamentous, with the reproductive organs irregularly scattered throughout. Some of the plants have occasionally been thought Algæ, and at other times Fungi.

(348.) The root-like holdfasts, by which Lichens are attached to trees, and fixed immoveably on rocks and stones, are named *fulcra*, or *ansulæ;* and the rootlets projected from the under surface of the thallus are called by some *fibrillæ*, but more properly *Rhizinæ*, [§ 346.] The tubercles with which the hypothallus is often thickly studded are called *cyphellæ*, and the hollows that occur in the epithallus are named *lacunæ*.

Occasionally the thallus is found to be double; when this structure occurs, the under portion is termed the *sub*-thallus, and the upper the *super*-thallus. It would appear that Fries sometimes confounds the *sub*-thallus in his definitions with the *hypo*-thallus. [§ 346.]

(349.) Rising from the epithallus there frequently are found minute arborescent productions, usually of a dark-green colour, called *pulvinuli;* they are abundant in *Parmelia glomulifera*, and are probably foreshadowings of more important parts to be immediately described. [See also the border of pulvinuli, in Gyrophora, § 338, fig. N.]

Parmelia Glomulifera.
(*a*) Entire plant.
(*b*) Portion magnified to shew the pulvinuli.

(350.) Such are the chief modifications of the thallus, as found in the various groups of Lichens, and such the names by which their several parts can be conveniently described. Other terms have been introduced, but they serve no further purpose than inconveniently to swell the catalogue of names.

(351.) When circumstances retard or prevent the development of the normal fructification, numerous bud-like organs are produced on various parts of the thallus, which are called *gonidia*, *conidia*, *gongyli*, &c. [§ 389, I, J.] These small powdery bodies, which spring like adventitious buds from any part of the surface

of the thallus, are the organs of reproduction in their simplest states. Sometimes they are very irregularly dispersed, but at others they are collected into groups, which are called *Soredia.* These are usually most abundant on plants growing in obscure places, where, from the absence of light, the normal fructification has become abortive; as in the leprarious forms of Lichens; and are less noticed when the spores are regularly evolved.

(352.) When the organs of reproduction become segregated and confined to especial parts of the thallus, such parts are called *Apothecia*, or *cases*, [§ 363, 367, &c.;] these cases are of various forms,* and according as they are absent, closed, or open, are the plants contained in this order distributed into various sections.

(353.) When the apothecia spring immediately from the thallus they are called *sessile*, [§ 338, fig. A, B, D, T, V, W.] if sunk with the substance of the thallus, *immersed* [§ 389, A, B, C, D,] but if they are raised by a prominence of the epithallus, they are called *stalked*, and the stalk is named the *podetium*, or, if very short, the *podicellum*, [§ 337, K, L, M, N, O, P.]

(354.) Each apothecium consists of the fructification itself; called, collectively, the *thalamium,* and the *excipulus*, or case that invests it; or, in other words, essentially of the *spores* in their *asci*, or *sporidia;* non-essentially of the *excipulus*, or partial receptacle, and medially of the *nucleus* or *lamina proligera*, to which the *asci* are attached.

(355.) When the excipulus is similar in its structure and appearance to the thallus, it is called an *Excipulus thallodes;* when dissimilar, an *Exc. proprius*.

The *excipulus* sometimes forms a bare margin round the *disk;* at others it rises so as nearly to enclose the *Thalamium.* In the one case the apothecia are said to be *shut*, [clausa, § 395,] in the other, to be *open*, [aperta, § 383.]

(356.) The opening of the *Apothecium* is called the *Ostiolum,* [§ 389, D;] and the open space, especially in *apothecia*, which are permanently patent, is called by some persons the disk; [§ 383, *e*,] occasionally a fine membrane, quickly perishing, covers the disk, which is called the veil, (velum.)

(357.) The lining of the Apothecium, often not distinguishable,

* The Apothecia are distinguished, according to their shapes, into Scutellæ, Patellulæ, Lirellæ, Pilidia, Orbillæ, Peltæ, Tricæ, Gyromata, Globuli, Mammulæ, Tuberculæ, Cistulæ, Cephalodia, Stromata, Spherulæ, and Thalamia.

but sometimes, as in *Verrucaria*, of a cartilaginous consistence, is called the *perithecium*.

The *hypothecium*, when it separates and comes out from the *apotheceum*, bearing the sporidia within the *periithecium*, is called, according to its form, either *lamina proligera*, [§ 337, G,] or *nucleus proligerus*, [§ 395, *c*, *d*.]

(358.) The *spores* are roundish cellules contained within elongated cells, called *sporidia* or *asci*, [§ 383, *f*, 395, *c*;] which are themselves enclosed within the disks of the Apothecia, or seated upon them. Elongated floccose cellules are likewise often found intermingled with the sporidia, resembling the paraphyses of Fungi: organs hereafter to be described. They are probably only sporidia lengthened, their spores being abortive.

The fructification in general is sometimes called *thalamium;* but at others this term is restricted to those apothecia which contain a nucleus proligerus within them, as *Variolaria*.

(359.) Such is the common structure of the Lichens; and from this conspectus it will be seen that, in their general anatomy, they closely resemble, in many respects, the other Algæ; for the root, stem, and leaf, are still sublatent, or united in one common stock or thallus, the structure of which is purely cellular; and the organs of reproduction are either gonidia, or spores, or both.

But in the Lichens the thallus becomes stratified, prefiguring, as some assert, a like disposition of textures in a higher grade, (the Dicotyledons, and other Exogenæ, of authors;) while the Phycæ are said to foreshadow the ferns, and other endogenous plants: the organs of fructification also become more and more decidedly external.

(360.) This, among other reasons, has induced me to prefer the terms *Mycaffines*, *Termaffines*, and *Crescaffines*, to *Cellulosæ*, *Endogenæ*, and *Exogenæ*, as collective names. For Fries, in strictly following out the classification founded on the structure of the vegetative organs, has arranged the Mosses and Lichens amongst the *Exogenæ*, the Fuci along with the other *Endogenæ*, leaving the Fungi alone, of all the cellulares, to form the class that he calls *Syngenæ*.

(361.) The Lichens and their allies, although, like the Fucales, for the most part, formerly included in a single genus, are now distinguished into many, which are distributed into several types and sections, according to the progressive development of the organs just described, and their relative modifications. The sec-

tions depend upon the thallus being stratified or unstratified, and the apothecia open or closed. The unstratified Lichenales are termed, from *Byssus*, the normal genus, the *Byssinæ;* and of the stratified Lichens, those having open Apothecia, are denominated *Cetrarinæ;* those having closed Apothecia, *Verrucarinæ;* from *Cetraria* and *Verrucaria*, the two normal genera of the respective groups. The types are distinguished by subordinate characters, hereafter to be explained.

(362.) Until lately, the system of arrangement devised by Acharius almost universally prevailed; but the distinction and distribution of these plants have been so much improved and simplified by Fries, that since the publication of his "*Lichenographia Europea Reformata*," no doubt can be entertained that his labours will form the foundation of all modern schemes: therefore, his method, with some few slight modifications to render it compatible with the principles of these Outlines, will be adopted here.

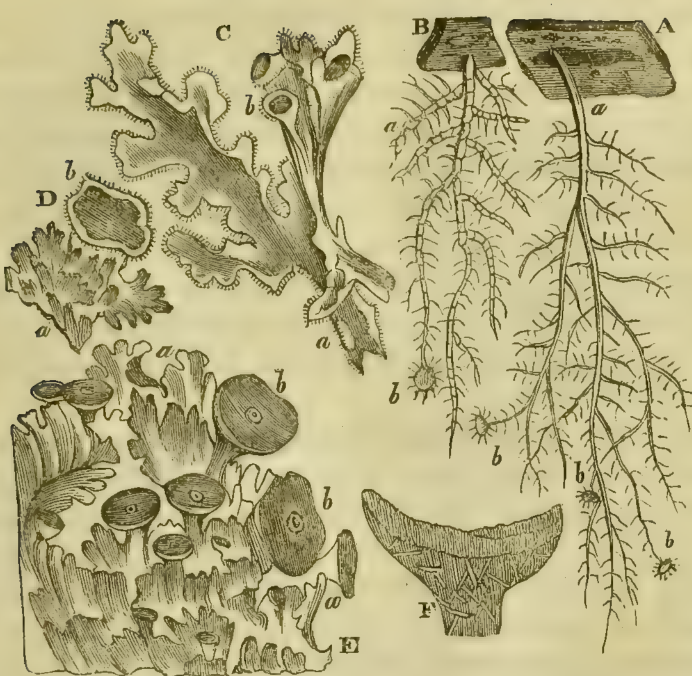
CETRARINÆ.

(363.) The *Cetraria Islandica*, formerly known as the *Lichen Islandicus*, or *Iceland moss*, is a familiar example of the most extensive and economically important section of the Lichenales. This section contains two well-marked types, and at least five subtypes, associated by having their "Apothecia open and disciferous;" these characters are common to them all, whence they have been sometimes termed the Gymnocarpi, or naked-fruited Lichens; but *Cetrarinæ* is perhaps a preferable name, not only from its being a derivative of a well-known normal genus, but also from its etymological reference to the open shield-like fructification that pervades and characterises the entire section.

(364.) *Parmeliaceæ. Parmelia* (the Shield-edge,*) and *Usnea*, (the Lichen-hair, or Beard-moss,)† are the normal genera of two subtypes, called, from them, the Usnidæ (or *Usneæ*,) and *Parmelidæ* (or Parmelieæ,) which, together, form the type *Parmeliaceæ*, the first that occurs in the section *Cetrarinæ*.

* From πάρμη, a little shield or target, and εἱλέω, to surround.

† From the Arabic *âchneh*, the common name of all Lichens among the Arabians.



A. Usnea barbata. (*a*) Pendulous vertical thallus. (*b*) Open apothecia. B. Usnea barbata, var. articulata. (*a*) Barren ramifications. (*b*) Shields. C. Cetraria islandica. (*a*) subvertical thallus. (*b*) Apothecia. D. Cetraria juniperina. (*a*) Thallus. (*b*) Apothecium. E. Parmelia perforata. (*a*) Foliaceous thallus. (*b*) Open perforated apothecia. F. Parmelia parietina. Section of open apothecium.

(365.) The *Usnidæ* are distinguished by having an open disk, and being destitute of hypothallus. Their thalli, likewise, are vertical, either pendulous or erect, for in their evolution the centripetal force predominates.

The several varieties of Usnea, known commonly as Jupiter's beard (*barba Jovis*,) Tree-beard (*Arborum barba*,) &c. are, with some species of the two following genera, *Evernia* and *Ramalina*, the chief Lichens "which clothe so profusely the trees of too thick or decaying plantations; a fir wood on moorish ground is in particular much infested with them. The fir, the birch, the ash, the oak, the sloe, and the hawthorn are, when old, always hung with this hoary livery; but the elm, the sycamore, the lime, and the beech, wear it not, or very sparingly; so that when Gray speaks of the 'rude and moss-grown beech,' he applies to it a character by no means appropriate, for no tree is so little or so seldom either rude or moss-grown."—*Johnson*.

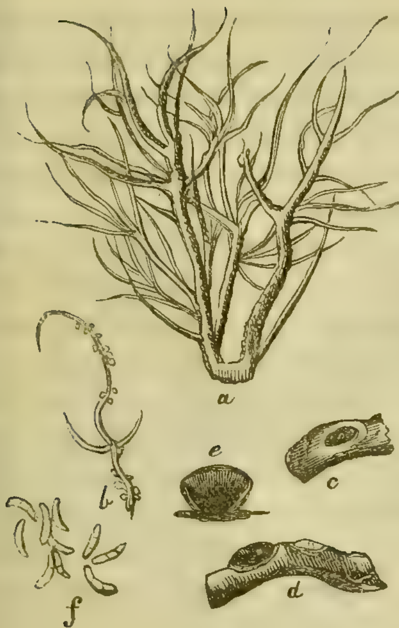
(366.) *Evernia*, a name admirably descriptive of the elegant branching thalli of the lichens to which it belongs, is derived from ἒυ, excelling, and ἕρνος, a branch. E. *prunastri* is one of the most common British species, and, from its peculiar power of imbibing and retaining odours, it is in much request as an ingredient in sweet pots and perfumed cushions; and Evelyn says, that this "very moss of the oak, that is white, composes the choicest cypress powder, which is esteemed good for the head; but impostors familiarly vend other mosses under that name, as they do the fungi for the true agaric, (excellent for hemorrhages and fluxes,) to the great scandal of physic."

One species of this genus, viz. Evernia vulpina, is said to be poisonous, at least to foxes; whence its name. It is curious that a deleterious plant should be found in such a generally innocuous group.

(367.) Lightfoot says that one species of Ramalina, the R. scopulorum, or rock-branchlet, (Lichen calicaris of Linneus, and L. scopulorum of Dickson,) "will dye a red colour, and promises, in that intention, to rival the famous L. roccella, or argol, which is brought from the Canary Islands, and sometimes sold at the price of £80. sterling per ton. It was formerly used, instead of starch, in hairpowder." Johnston adds to this account that another species, the R. farinacea, affords a mucilage as good as that obtained from the Cetraria islandica.

(368.) *Roccella*, a corruption of the Portuguese *Roccha*, is a name given to several species of lichen, in allusion to the situations in which they are found, delighting to grow on otherwise barren seaward rocks, that thus produce a profitable harvest. Tournefort considers that one species at least (R. tinctoria) was known to the ancients, and that it was the especial lichen (λειχὴν) of Dioscorides, which was collected on the rocky islands of the Archipelago, from one of which it received the name of the "*purple of Amorgus*."

Both R. tinctoria and fuciformis are indigenous to Britain; they are found, though sparingly, on the maritime rocks of our southern coasts, especially in Portland Island; but in the Canary and Cape de Verd Islands, in Barbary, and the Levant, the former is common; and the latter, which "attains a much larger size, and is reported to vie in richness of colouring with the common orchill, is said to abound in the East Indies, especially on the shores of Sumatra;" and hence may probably become an important article of commerce.



Roccella tinctoria.

(*a*) Entire plant.

(*b*) Portion with fruit.

(*c, d*) Portions with apothecia magnified.

(*e*) Section of apothecium.

(*f*) Sporidia.

(369.) Under the name of *Archill*, or *Orchell*, (the Orcella of the Italians, and the Orseille of the French,) large quantities of this lichen are annually imported into this country, varying from ninety tons and upwards per annum. In times of scarcity it has fetched as much as £1000. per ton, but its usual price is not above a fourth part of that sum. The Canary orchell sells now at double the price of the Madeira, and the Barbary is the least esteemed of all: the former being sold at £290. per ton, while the second and third are only worth £140. and from £30. to £45. respectively.

(370.) The ancient mode of preparing orchell is said to have been lost, and rediscovered casually by a Florentine merchant, in the year 1300; and its preparation was long kept a secret by the Florentines and the Dutch. The former, to lead other manufacturers astray, called it *tincture of turnsole*, pretending that it was extracted from the Heliotropium, or turnsole; and by the latter it was made into a paste, which they called *lacmus*, or *litmus*. At present it is well known that the process consists in cleaning, drying, and powdering the plant, which, when mixed with half its weight of pearlash, is moistened with human urine, and then allowed to ferment. The fermentation is kept up for some time by successive additions of urine, until the colour of the materials

changes to a purplish-red, and subsequently to a violet or blue. The principal British manufactories are in London and Liverpool. The colour of orchil is extremely fugitive, and it affords one of the most delicate chemical tests for the presence of an acid. The vapour of sulphuric acid has been thus detected, as pervading to some extent the atmosphere of London.

(371.) *Cetraria* [§ 364, fig. C, D,] from *cetra*, a Moorish buckler, is the modern systematic name of the genus that contains the Lichen islandicus, or Iceland moss, which in commerce is often mixed with another species, the C. odontella. Several species are natives of our alpine woods and mountainous heaths. Sir James E. Smith found the Islandica on the Pentland hills, on Ben Lomond, and in various parts of Scotland. It grows, however, much more freely in the more northern parts of Europe; and Dr. Holland states that it abounds on the lava on the western coast of Iceland, where the whole plant is much more luxuriant than with us.

The bitter and purgative principles of this Cetraria may be separated by steeping it in cold water, which is done by the Icelanders and other northern nations, with whom it forms an important article of food; these poor people with gratitude confessing that out of the rock the Almighty gives them food; commanding that the very stones should furnish bread.

(372.) Immense quantities of this lichen are annually collected in Iceland for exportation, as well as for home consumption. After steeping in cold water, drying, and powdering, the Icelanders make it into cakes, or eat it boiled in milk; and Henderson, in his Tour through Lapland, says that a porridge made of this lichen flour is to a foreigner not only the most wholesome, but also the most palatable, of all the articles of Icelandic diet.

The esculent qualities of the Iceland moss have been long recognised in many parts of the continent of Europe; and it has lately been recommended by authority to use it, either alone or mixed with flour, in the composition of bread in times of scarcity. The Saxon government have published a report on this subject, which is full of interesting information to the inhabitants of those mountainous districts where the plant abounds. In this report we are informed that 6 lbs. and 22 loths of lichen meal, boiled with 14 times its weight of water, and baked in this state with 59½ lbs. of flour, produced 111½ lbs. of good household bread. Without this

addition, the flour would not have produced more than $78\frac{3}{4}$ lbs. of bread; consequently, this addition of 6 lbs. and 22 loths of lichen-meal has occasioned an increase of $32\frac{3}{4}$ lbs. of good bread. It is known that 3 lbs. of flour yield 4 lbs. of household bread; 1 lb. of lichen-meal added, in the form of paste, gives an addition of nearly 6 lbs., and therefore is equivalent in this view to about $3\frac{3}{4}$ lbs. of flour, because it affords above $3\frac{1}{2}$ times more bread. But, notwithstanding this important fact, at present nearly all the Iceland moss collected in Germany is sent, through Hamburgh, to England, where it is used in brewing and in the composition of ship-biscuit; as it is said biscuit which contains it is not attacked by worms, and suffers little from the action of sea-water. This lichen, when deprived of its bitter principle, forms an excellent soup, and, when coagulated, a good jelly; and it has been recommended in this prepared state as an excellent substitute for sago, salop, and even for chocolate.—*Ed. Phil. Journ.* iii. 414.

(373.) Of the *Parmelidæ*, the second subtype of the *Parmeliaceæ*, the genera *Peltigera* (the shield-bearer, *Sticta*, and *Parmelia*, [§ 364, E, F,] are the most notable examples. This subtype is distinguished from its congener, the Usnidæ, by having the thallus horizontal, the centrifugal evolution predominating, and the hypothallus being present; the disk likewise at first is closed, although it subsequently opens.

(374.) The two most noted species of the genus Peltigera (or target-bearer), are the *canina* and *aphthosa*, both handsome plants, especially the latter, which, from its aphthoid appearance, is much esteemed by the Swedish peasants, who boil it in milk as a remedy for the thrush; but, since the doctrine of signatures has fallen into disrepute, it maintains its credit, like the canina, only among the ignorant. P. canina owes its name to a former belief of its efficacy in the cure of canine madness. "The powder of the dried plant was celebrated by Dr. Mead as a certain cure, and Dillenius gives the history and receipt at full."—*Johnson.*

(375.) Of *Parmelia* [§ 349 and 364,] a very extensive genus, including, according to Fries, eight subgenera, the bare mention of which must now suffice, the yellow moss, and the cudbear, are the most familiar and important examples. The first-named species, P. parietina, clothes profusely the boughs of the hawthorn, and many other trees, in autumn, with a tunic of a bright-yellow hue. Lightfoot says, "It is affirmed to dye a good yellow, or orange

colour, if mixed with alum." P. tartarea has long been used, both by the Welsh and Scotch, as a dye for wool; but it was first extensively employed by Dr. Cuthbert Gordon, who took out a patent for his process, and whose Christian name, Cuthbert, or Cuddy, corrupted into *cudbear*, has been given to the dye-stuff. About 130 tons of cudbear are annually exported from Sweden; it sells in the port of London at about £20. per ton. A good deal likewise is collected from our own rocks. Hooker says, that in the neighbourhood of Fort Augustus a person could earn, in 1807, 14*s*. per week at this work, the material selling at 3*s*. 4*d*. the stone of 22 lbs.; and Johnston adds, that in the highland districts many an industrious peasant gets a living by scraping this lichen off the rocks with an iron hoop, and sending it to Glasgow market. Like most other lichens, it is a perennial plant, but of such tardy growth, that the crops can scarcely be collected with advantage oftener than once in five years.

(376.) Another species, the P. parella (*Lecanora parella*,) is said, by the same writer, to afford the finest litmus; and the P. candelaria has so been named from its being employed by the Swedes to stain the candles they use in their religious ceremonies. Several other species likewise afford dye-stuffs, especially the P. omphalodes, which Pennant says formed, in 1772, an important article of commerce from the west of Scotland, being sold at 1*s*. or 1*s*. 4*d*. per stone. This lichen, which was formerly much used by the peasants in our provinces to dye their woollen cloths of a dull-brown colour, and, when steeped in urine, was employed by the highlanders for similar purposes, and known under the name of Crostil, or Crostal, seems to deserve more attention as a source of colouring matter than it has hitherto received. It is said that it imparts easily a tawny-red hue to a solution of volatile alkali, and that this infusion affords one of the most indestructible of all colours. Indeed, Dr. Walker declares, that "the colour remains after the substance that extracted it is gone; it is not the least impaired by long exposure to the air; nor can it be either destroyed or changed by acids, alkalies, or alcohol; a most singular property, as there is no red dye in use that remains unaltered by these powerful agents."

(377.) Of the genera *Sticta*, *Dirina*, and *Gyalecta*, little need now be said, further than that the first-named genus affords some of the most handsome lichens known; and one species, the S. pulmonacea, or lung-wort, has been much praised as an excellent medicine in pulmonary complaints, if indeed it can be considered pra ise

to say that its curative effects in consumption are equal to those of the far-famed Cetraria islandica. With these plants the subtype *Parmelidæ* concludes, a subtype by which, with the Usnidæ, already noticed, the type *Parmeliaceæ* is formed.

However much these plants may differ in various subordinate particulars, they all agree in having roundish persistent disks, bordered by thalloid excipuli; and this structure therefore becomes the distinguishing characteristic of the type.

(378.) *Graphidaceæ*, the second type of the *Cetrarinæ*, to which *Graphis* (the *scripture-wort*, § 338, D), gives name, includes three subtypes, the *Lecididæ*, *Graphidæ*, and *Calicidæ*; the second, and perhaps even the two last, of which are but artificial divisions of the one first named: still, however this may be, it is as well they should be retained, as the distinctions are practically convenient.

(379.) The different species of Lecideæ are, especially in mountain districts, familiar to almost every eye, and are interesting from the indications they afford of the nature of the soil on which they grow, some being absolutely saxicolous, while others are found on other soils. Of these, perhaps, the L. geographica is one of the most elegant, if any selection can be made from a group where all are exquisitely beautiful, notwithstanding their minuteness veils their beauties from almost every eye. The corticolous Lecideæ are likewise worthy attention, from the diagnostic signs which they afford of several of the officinal barks upon which they respectively abound, as the aurigera on the brown, the tuberculosa on the yellow, and the conspersa on the red bark.

(380.) But the most interesting and important illustration of this subtype will be found in the well-known reindeer moss, the *Cladonia* (or *Cenomyce*) *rangiferina*, of which, although indige-

Cenomyce coccifera.

Cenomyce uncialis.

nous with us, the specimens that are common on our moors are very insignificant to those which are furnished by more northern climes. In the arctic regions, and especially in Lapland, it grows in the utmost profusion, and overspreads, as with a coverlid of snow,

plains hundreds of miles in extent. These, which to a stranger, or a traveller arrived from what prejudice would call a happier land, might seem dry and barren wastes, are the very fertile fields of the Laplanders, "Hi sunt Lapponum agri, hæc prata eorum fertilissima, adeo ut felicem se prædicet possessor provinciæ talis sterilissimæ, atque lichene obsitæ;" for, when the cold of winter has withered up every sort of herbage, and its storms have driven man and beast to the shelter of the valleys and the woods, this moss becomes the principal aliment of the herds of reindeer, in which consists all the wealth, and on which depends the very existence of the natives. "Thus things," says Lightfoot, "which are often deemed the most insignificant and contemptible by ignorant men, are, by the good providence of God, made the means of the greatest blessings to his creatures." According to Linneus, the Laplanders likewise collect the C. rangiferina with rakes in the rainy season, when it is flexible, and separates readily from the ground, lay it up in heaps, and give it when required to their cows, for which it affords excellent fodder. "At the limits of the arctic circle there is a brood of cows so small, as not to be larger than sucking calves. Their milk is almost all cream; sweet and delicious, and so thick that it draws out in strings. This goodness of milk arises from the plant on which the cows feed, viz. the Lich. rangiferina."—*Bucke's Harmonies of Nature*, ii. 149.

(381.) *Cenomyce rangiferina* may even be directly applied to the use of man. Tempted by the beauty of its appearance, Dr. Clarke and his companions in travel, tasted it. "To our surprise (he says), we found that we might eat of it with as much ease as of the heart of a fine lettuce. It tasted like wheat-bran; but, after swallowing it, there remained in the throat and upon the palate a gentle heat, or sense of burning, as if a small quantity of pepper had been mixed with the lichen. We had no doubt that if we could have procured oil and vinegar, it would have afforded a grateful salad. Cooling and juicy as it was to the palate, it nevertheless warmed the stomach when swallowed, and cannot fail of proving a gratifying article of food to man or beast during the dry winters of the frigid zone. Yet neither Laplanders nor Swedes eat of this lichen. Finding it to be so palatable, we persuaded our servants to taste it; and, after experiencing the same effects from it that we had done, they began to eat it voluntarily. Upon this we asked the peasants why they neglected to make use of so important an article of food, in a land so sterile as that which we were now travers-

ing. They told us that, when Gustavus III. succeeded to the throne, an edict was published and sent all over Sweden, recommending the use of this lichen to the peasants in time of dearth; and they were advised to boil it in milk. Now and then, they said, a few of the indigent poor had made it serve as a substitute for bread; but being unaccustomed to such food, they generally neglected it."—*Clarke's Travels*, Part iii. § 1, p. 566. "Nor is this to be wondered at, for Clarke had tried it only in a solid and unprepared state, and was incompetent therefore to say what sort of food it might really make, which, from the account of Dillenius, is, in fact, indifferent enough. "Aquâ quidem decoctus hic muscus nullam gelatinam præbet, nec substantia ejus imminuitur, siccatus tamen fragilior, quam ante, evadit. Decoctum inspissatum extracti acerbi et austeri parcam quantitatem largitur."—*Johnson.*

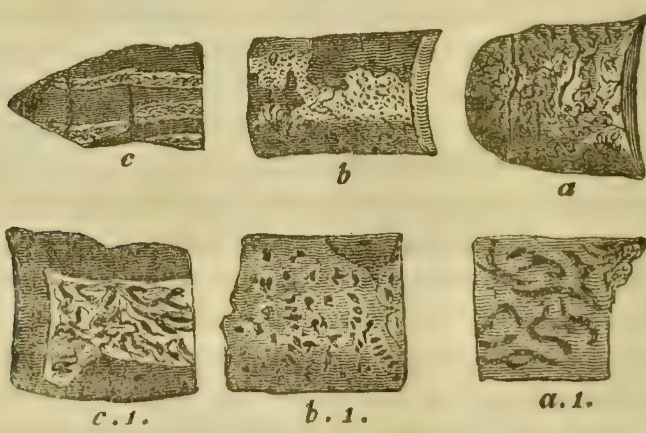
(382.) *Lecidea*, and those more immediately normal genera, such as *Cladonia*, *Stereocaulon*, [§ 338, fig. E, F, G.], *Bæomyces*, [§ 338, fig. K, L, M.], and *Biatora*, in which the persistent disks are roundish, and the proper excipuli at first are open, and subsequently half enclose the thalamia in cephaloid apothecia, form the subtype *Lecididæ*. From these, the *Graphidæ*, in which, although the excipuli when present are proper, the disks are irregular, and often lirelliform, and the *Calicidæ*, in which the proper excipuli enclose orbicular or subrotund disks destitute of sporidia, are seceding or degenerate groups; for in the *Graphidæ*, although the excipuli when present are proper, the disks are irregular, (often lirelliform): and in the *Calicidæ*, although the proper excipuli enclose orbicular or subrotund disks, the sporidia are wanting.

(383.) Of the subtype *Graphidæ*, *Umbilicaria*, the naveling and *Opegrapha*, the *chink-writ*, are well-known examples, [§ 384.] Some species of the first-named genus, (including, according to Fries, the Gyrophoræ [§ 338, N, O, P, Q, R, S.] of other authors), furnish the rock-tripe of the Canadian hunters, upon which they often for a time subsist; and these plants have lately become peculiarly interesting to us, from their affording opportune and very welcome food to our adventurous countrymen, in their travels towards the Pole.

One species of *Graphis*, the normal genus, viz. *G. interrupta*, is said by Fee to be found only on the bark of *Cinchona lancifera*. Hence plants of this kind become practically very useless guides, enabling the true officinal bark to be distinguished from other substances with which in commerce they are often mixed. Several

of the Opegraphas, and other lichens, are, in a similar manner, diagnostic of various barks; and not only do they indicate the species, but many, as *Opegrapha rhizicola* [Fee xiii. 2], *Fissurina*, &c., distinguish those specimens which have, either from age or decomposition, become unfit, from those which are fit, for medicinal purposes.

(384.) Until the publication of Fee's Memoir on the cryptogamic epiphytes of the officinal barks, the study of the opegraphas and their allies seemed to be one rather of speculative amusement than of practical utility. But now the case is wholly changed, since these graphic plants, these living letters written by nature's hand, are shewn to constitute inscriptions legible by men. Always curious indeed, and admirable, even to the least tutored eye, did the examination of these mimic characters appear; and as fancy traced the likeness to various oriental signs, so were these little plants called scripture-worts, some Hebrew (Opegrapha hebraica), some Chinese (Arthonia sinensigrapha), and so forth. But, like the hieroglyphics of the Egyptian fanes, their meaning was buried in obscurity, and so little guessed at, that it often was doubted whether they had any secrets to reveal. They were sources of wonder rather than of wisdom, until the Young and the Champollion of the vegetable world arose, and by means of a natural Rosetta-stone



(*a*) Opegrapha Condaminea. (*a* 1) Ditto, magnified. (*b*) Enterographa Quassiæcola. (*b* 1) Ditto, magnified. (*c*) Sarcographa cascarillæ. (*c* 1) Ditto, magnified.

deciphered these hitherto unknown manuscripts, and taught us to peruse this part of the sacred Scriptures of creation.

(385.) *Calicium* and *Coniocybe*, verging towards the fungi, form the subtype *Calicidæ*, the chief distinctive characters of which are their orbicular or roundish disks, encompassed by pro-

per excipuli, (which, however, are sometimes obscure or wanting,) and the degenerate state of the sporidia.

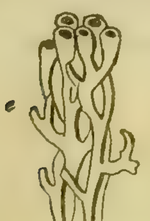
These lichens are found to flourish upon putrid wood and other decaying vegetable substances, as well as upon old trees, the earth, and stones; and some of them were formerly included by Linnæus among his Mucores. Persoon likewise enumerates them in his Synopsis Fungorum amongst the fungi; and as Fee observes, were it not for their lichenoid crust, they might well be associated with the mucedines, which they resemble in general appearance, and almost in their structure. Acharius, also, who carefully investigated the genus *Calicium*, and published the result of his researches in a monograph, determined it to be a Lichen, and Fries, and most modern authors defer, and with justice, to their combined authority. Hence, among the Calicia will be found the late *Trichia*, or *Mucor Lichenöides*; and to *Coniocybe* are referred the old *Mucor furfuraceus*, *fulvus*, *sulphureus*, and so forth.

(386.) In the three subtypes Calicidæ, Graphidæ, and Lecididæ, the excipuli, when present, are always proper, and hence the type *Graphidaceæ* or *Opegraphaceæ* is formed; a type which is thus well distinguished from the *Parmeliaceæ*, in which the excipuli are always present and always thalloid.

(387.) These two types, though differing in their thallode and proper exciples, agree in having their apothecia open and disciferous, and thus, by their gymnocarpous structure, they collectively form the section *Cetrarinæ*, as already stated.

VERRUCARINÆ.

(388.) *Pertusariaceæ.* The Coral moss, Isidium (or Sphærophoron), corallinum, and other species of Sphærophora, as the coralloides, or coral atlas-work, are beautiful illustrations of a small subtype, in which the thallus is developed vertically, the excipuli are purely thallode, closed, and having a lacerated dehiscence. From the normal genus the group is denominated the *Sphærophoridæ;* and in beauty they yield to none even in an order where, as already observed, elegance is the common lot of all. They are easily distinguished by their peculiar coralline form and suffruticose habit, as well as by the characters above described. None of them have as yet been employed to any extent for economical purposes; but Westring has found the *Isidium corallinum* to be "extremely rich in colouring matter,

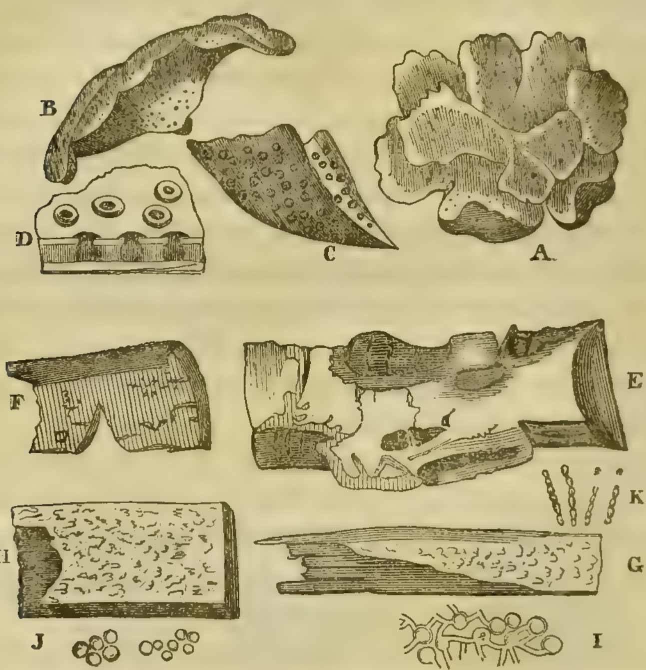


Isidium corallinum.

and he recommends it to the particular attention of those who practice, and who wish to improve, the art of dyeing."

(389.) In the allied subtype, containing the genera *Endocarpon*, *Chiodecton*, *Pertusaria*, and others, which, from the first-named genus, is called the *Endocarpidæ*, the thallus s horizontal, and in all but *Endocarpon* it is crustaceous; the closed excipulus is thalloid, and is pierced by an ostiolum.

(390.) *Endocarpon* has been well named with reference to the



A. Endocarpon miniatum. B. Portion of thallus. C. Section of ditto. D. Ditto, magnified, to shew the immersed apothecia and ostioles. E. Hypochnus rubro-cinctus. F. Portion removed from the bark. G, H. Lepraria flava. I, J. Portions removed from the wood. K. Monilia.

imbedding of its apothecia in the thallus; a character that hereafter will be seen (through Riccia) to connect the Lichens with the Hepaticæ, which were once, like them, considered Algæ. These plants are sessile on rocks, stones, &c., and one species is even parasitic upon an ally, *Pertusaria omphalodes*.

(391.) *Chiodecton*, the snow-wart, so called from χιων and δεκτικος, the tubercles being seated on a thallus, white, like drifted snow, promises to become an important diagnostic sign of the bark of the Cinchona cordifolia, to which one species (C. effusum?) is said by Fee to be peculiar.

(392.) *Pertusaria*, the porelet, (from pertusus, perforated,) and its ally, *Thelotrema*, (from θηλη, a nipple, and τρῆμα, a hole,) are further illustrations of this subtype. They are chiefly interesting as affording two further distinctive signs of officinal barks, the latter, (T. urceolare) of the Cinchona oblongifolia, or red bark, the former in that variety of *P. communis* called amara, (*Variolaria amara* of some writers,) of the inferior value of the barks on which it is found. According to Fee, this lichen chiefly grows on the very old bark of Cinchona cordifolia, and denotes by its presence a bad quality. *Variolaria amara* is itself, as its name imports, extremely bitter; and as it is very abundant in many districts, it ought, as the same Lichenologist observes, to have its medicinal properties ascertained, for, probably, it might be employed with advantage in certain diseases; it readily imparts its intense bitterness both to water and spirit.

(393.) These two tribes, or subtypes, the *Sphærophoridæ* and *Endocarpidæ*, although differing in the minor characters of their vertical and horizontal thalli, and in their regular and irregular dehiscence, still agree in the more general characteristic of having in common thallöid excipuli, and hence they form together the type *Pertusariaceæ*, which is thus distinguished from that which follows, viz. the Verrucariaceæ, in which the excipuli are proper.

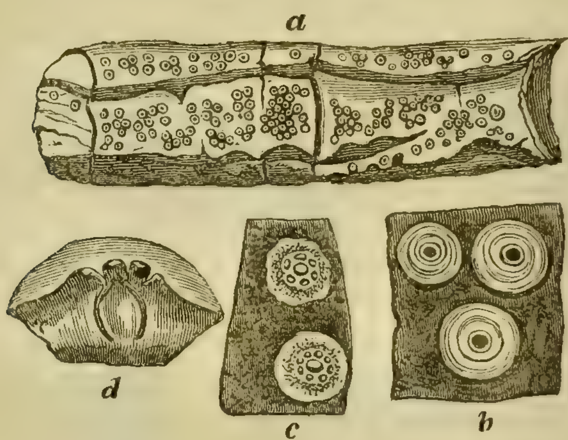
(394.) *Verrucariaceæ*. *Verrucaria*, the *wart-let* (from verruca, a wart,) and *Gassicurtia*, [§ 338, T, V, W,] an exotic genus, said by Fee to be found exclusively on the yellow bark, (Quinquina jaune royal,) and to which therefore, in commerce, it is an admirable guide, will serve as examples of the first type of the first section of this order; a section which, from Verrucaria, receives the common name of Verrucarinæ, as Verrucaria has been so called from its resemblance to a wart.

(395.) In these plants and their immediate allies the apothecia, are closed and nucleiferous; hence the section has been called Angiocarpous, but consistency compels a preference of denomination from its normal genus Verruca, and hence it is above described as the section VERRUCARINÆ.

(396.) *Verrucaria* and its allies, forming the small subtype *Verrucaridæ*, chiefly differ from the Endocarpidæ, to which, with the exception of their proper excipuli, they are very similar, by the non-dehiscence of the apothecia, and the nucleus being deli-

quescent. The species, both European and exotic, are very numerous, and a great many are epiphytic on the officinal barks, but in this respect they are such cosmopolites that they do not afford any very decided differential signs, or at least the distinctions have not as yet been sufficiently made out. One species of *Ascidium*, which grows commonly on several of the officinal barks, may be given as an illustration.

Ascidium Cinchonarum.



(*a*) Group of plants natural size. (*b*) Portion magnified. (*c*) Ditto after the lapse of the perithecium, shewing the sporidia in the thalamium. (*d*) An apothecium separate and magnified; section to shew the nucleus proligerus.

But although these and many other epiphytic lichens do not each indicate specific plants, their general presence or absence will often assist in discriminating otherwise nearly similar vegetable productions. For example, it has been already mentioned [§ 365,] that the Beech, though not absolutely destitute of lichens, is far less licheniferous than the oak, the ash, the hawthorn, or the fir; and in like manner it has been found that the spurious angustura bark, which is obtained from a species of *Brucea (B. antidysenterica,)* and which contains a poisonous principle analogous in its properties to *Strychnia*, bears very few lichens of any kind; while the true *Cusparia febrifuga*, which is an admirable tonic, bears them in abundance.

(397.) Limboria (the borderlet,) Pyrenothea (the nutlet,) and several other seceding genera, which verge towards the Calicidæ of the Cetrarinæ, and the Leprariaceæ of the Byssinæ, constitute the subtype Limboridæ, that concludes this section. They differ

from the Verrucaridæ in their varied and irregular dehiscence, and the carbonaceous character of their exciples; although both subtypes agree in having proper excipuli and crustaceous thalli; and hence they, together, form the type *Verrucariaceæ*, with which the section Verrucarinæ closes.

(398.) The lower rank of these Lichens is well shewn from several, as the *Pyrenothea incrustans*, *vermicellifera*, &c. having been formerly considered Leprarias and Lepranthas.

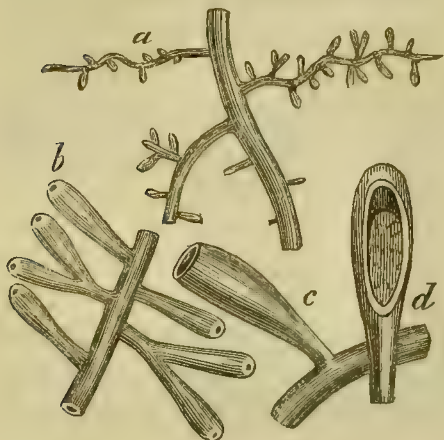
BYSSINÆ.

(399.) As the plants contained in the lower grades of the two superior sections approach so closely to the characters of fungi that they have often been considered such, it is evident that the systematic location of those included in the one now to be examined must be still more debateable. And this will be found to be the case, for *Byssus*, *Rhizomorpha*, and their allies, which form the two types *Byssaceæ* and *Rhizomorphaceæ* of the *Bysso-Lichens*, or BYSSINÆ, are by some considered as subordinate groups among the *Fungi*, by some among the *Lichens*, and by others, who perceive and confess their affinity to both, they are elevated into an intermediate order independent of either; a rank which they seem to have no just claim to hold, since their distinctions and connexions are sufficiently denoted when they are arranged as the lowest section of the Lichenales bordering on the lower fungi, and running parallel with them.

(400.) Such is their distribution in the present scheme, and such is nearly the rank assigned to them by Fries, with whom Greville agrees in the propriety of their removal from the true fungi. By both these eminent Cryptologists they are defined to be "Aërial Algæ, flourishing perennially, and consisting of a persistent and little changing filamentous texture of turgid fibres, (either free or blended into a common stratum,) and with their fructification external, naked, and homogenous." These characters, which distinguish them as a section of the Algæ, will likewise sufficiently remove them from the fungi, the only other group with which they have any chance of being confounded, if the rudimental states of some higher plants, and certain ambiguous, and probably wholly lifeless productions, be excepted: of which more hereafter.

(401.) *Rhizomorphaceæ.* The *Rootmoss*, (Rhizomorpha,) so

called from the radiciform elongations of its thallus, gives name to the *Rhizomorphaceæ*, the first type in the section *Byssinæ*.



Rhizomorpha divergens.

(*a*) Plant, natural size.

(*b*) Portion with fruit magnified.

(*c*, *d*) Sections of the fruit, or pseudo-perithecia containing spores.

(402.) The several species of the genus *Rhizomorpha*, such as *subcorticalis*, *divergens*, *subterranea*, *phosphorea*, &c., are very common on the trunks of dead trees, especially beneath the bark of firs; in cellars, particularly wine-cellars, among the saw-dust; in lead and coal mines, and other similar situations; thus shewing, by their vegetating in the dark, their secession from the normal Lichens.

(403.) These plants are active agents in decorticating dead trees, and assisting in the disintegration of lifeless organic bodies, which would otherwise encumber the surface of the earth, and be exceedingly tedious in their removal. Portions of bark several feet in length, or even extending from the base to the boll of a large tree, will, when the *Rhizomorphæ* locate themselves between it and the wood, soon become so far loosened as either to fall off spontaneously, or to be unable to resist the slightest external force; and trees thus debarked are quickly preyed upon by Fungi, and other wood-destroying plants and animals.

(404.) Several species, especially *subcorticalis*, *subterranea*, and *phosphorea*, are occasionally phosphorescent, and more or less luminous in the dark; and hence they often give to the cellars and mines in which they grow an extraordinary and brilliant appearance. In the coal mines in the vicinity of Dresden they are said to be so abundant and so luminous, as even to dazzle the eye by the brilliant light that they afford. This light is increased by the warmth of the mines; so that, hanging in festoons and pen-

dents from the roof of the various excavations, twisting round the pillars, and covering the walls, they are said, by their brightness, to give to the Dresden coal mines just mentioned, in which they abound, the semblance of an enchanted palace. Mr. Erdman, the commissioner of mines, thus describes the appearance of the Rhizomorphæ in one he visited:

"I saw the luminous plants here in wonderful beauty; the impression produced by the spectacle I shall never forget. It appeared, on descending into the mine, as if we were entering an enchanted castle. The abundance of these plants was so great, that the roof and the walls and the pillars were entirely covered with them, and the beautiful light they cast around almost dazzled the eye. The light they give out is like faint moonshine, so that two persons near each other could readily distinguish their bodies. The lights appear to be most considerable when the temperature of the mines is comparatively high."

(405.) The type *Rhizomorphaceæ*, characterized by having the sporidia internal, includes, according to Fries, two subtypes, in the first of which the sporidia are contained within a pseudo-perithecium, formed by the collocation of the turgid fibres of the thallus. The thallus likewise, in this subtype, is continuous, radiciform, of a dark colour verging to black, and formed of many filaments blended into a common stratum. *Rhizomorpha* is the normal genus, and hence it is called the *Rhizomorphidæ*. *Ascophora* seems a doubtful ally, although by Fries referred to this group.

(406.) The *Rhizomorpha cinchonarum* is a rare species, but whenever found, it is a sufficient indication of the worthless state of the barks it grows upon, demonstrating by its presence that their medicinal qualities are much impaired, if not entirely cancelled by putrescency.

(407.) *Cœnogonium*, (from κοινὸς and ω'νια, the reunion moss,) *Himantia*, the thonglet, (from 'ιμὰς, a thong or bridle,) and Ozonium, (from ὄζος, a branch,) the branch-mould, are examples of the second subtype of the Rhizomorphaceæ, which, from the first-named genus, has been called the *Cœnogonidæ*. In these plants and their allies the sporidia are situated within an open excipulus, which is often, either normally, or from abortion, subascigerous; the fibres of the thallus likewise, although occasionally more or less interwoven, are mostly free, and only subcontinuous; thus shewing, in more respects than one, *e.g.* both by their free and articulated fibres, as well as by the absence of sporidia, an approach to the *Byssidæ*.

(408.) *Cœnogonium* was considered a conferva by Agardh, but this opinion is manifestly erroneous; both its structure and its station plainly indicate its affinity to the Bysso-Lichens.

(409.) *Himantia Cinchonarum* shews, according to Fee, a subputrescent state of the barks on which it is found, and is an evidence that their decomposition is so far advanced, that all specimens which bear it should be at once rejected for officinal purposes.

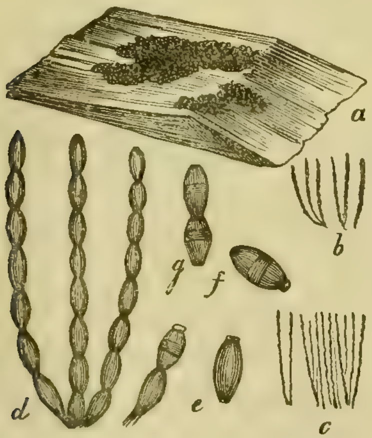
(410.) *Byssaceæ*. *Racodium*, the rag-moss-leather, (from Ράκιον, a worthless worn-out garment,) and *Hypochnus*, the undergnaw, (from ὑπὸ and χνανώ,) are among the most common and important illustrations that can be given of the subtype *Racodidæ*, which, with the allied subtype *Byssidæ*, including *Byssus*, the flaxlet, *Monilia* the beadlet, *Aspergillus*, the brushlet, and others, form together the type Byssaceæ.

(411.) The *Byssaceæ* are distinguished by their sporidia, when developed, being external, and the flocci of the thallus being free or subdiscrete; the subtypes are known by the dark cloth-like thallus in the *Racodia* being continuous, and the flocci non-articulate, although in the divisions obscure septa may be traced; while in the *Bysseæ* or *Byssidæ*, the flocci are jointed, moniliform, and discrete. In the *Byssidæ*, likewise, the sporidia are mostly absent, propagation often taking place by division of the thallus.

(412.) The *Mouse-skin rag-leather*, (*Racodium cellare*,) is very common in wine-cellars; forming a kind of whimsical tapestry on the walls and roofs, covering the casks, and investing the bottles with adventitious tunics; when compressed, it resembles the skin of a mouse, and is said to be an excellent styptic. In the wine-cellars under Welbeck chapel, Marylebone, the *Racodium* is so abundant, that it forms a really curious and interesting spectacle. The long vaults in several of the cellars where wine is kept, or where the casks and full bottles are, or where the bottling is carried on, are covered with it, hanging so low as to knock against the men's heads as they go along. In the cellars where the empty bottles are stored very little of the *Racodium* is seen.

(413.) Of *Hypochnus*, an allied genus, two species, viz. the *rubrocinctus* and *nigrocinctus*, [§ 390, E, P,] are found on the barks of various cinchonas. When in any quantity they are bad omens, as plants of this type seldom grow excepting on dead or sickly trees. The *Hypochni* are very repulsive of water, continuing dry even when submerged.

(414.) Of the subtype *Byssidæ*, (or *Bysseæ*,) the *bead-mould*, (*Monilia*,) especially that species known under the name of *blue-mould* in cheese, (Monilia glauca, or *Aspergillus glaucus*,) will form, perhaps, the most familiar illustrations. These little plants, as common experience shews, increase with wonderful rapidity, owing to the vast profusion of their offsets. The latter vary in colour



Monilia attenuata.

(*a*) Natural size.

(*b*, *c*) Filaments separated.

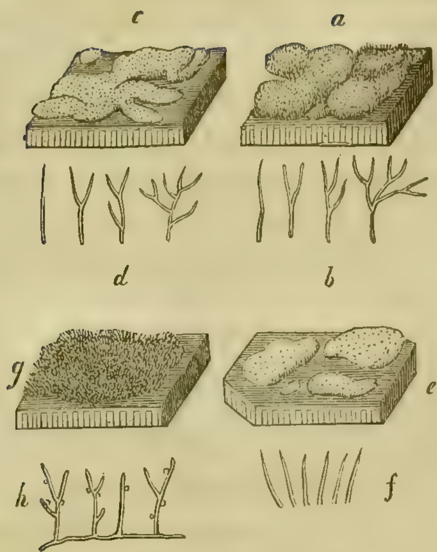
(*d*) Same, much magnified.

(*e*) Disarticulated joints.

(*f*, *g*) Ditto with dark masses within them (? abortive spores.)

from a light to a very deep glaucous hue, and add so much to the epicurean value of cheese, that fraudulent dealers endeavour to imitate the colour given, by the verdigris which is quickly formed on the brass pins that they stick in cheese. Another species, the *penicillatus*, which, with the glaucus, has been separated from the old genus, *Monilia*, under the name of Aspergillus, or *brushlet mould*, is a very elegant plant, of a dark-grey colour, and as common on damp plants in herbaria as the *A. glaucus* is on fruit and cheese.

(415.) Several Byssus-like plants, which I cannot but think are better associated with the foregoing in the present type of the Byssinæ, than with the Confervales, are still retained by many botanists of authority among the confervoid flags. These are chiefly some very doubtful plants, now formed into the genus Chroolepus, which includes the old *Byssus aurea*, *Iolithus*, &c., and a curious group of Bysso-Lichens that are half aquatic. These latter are found on the surface of various chemical and other solutions, such as ink, rose-water, Baryta water, isinglass size, &c. Collectively they are formed into the genus *Hygrocrocis* (or *damp tuft*), and their specific names refer to their various stations, *e. g.*, *H. Atramenti*, the tufts of plants found in ink, *H. Rosæ*, the beautiful roundish floating masses of down seen in rose-water, and so on. Whether *Myci-*



(*a, b*) Byssus aurea.

(*c, d*) ——— viridis.

(*e, f*) ——— Iolithus.

(*g, h*) ——— velutina.

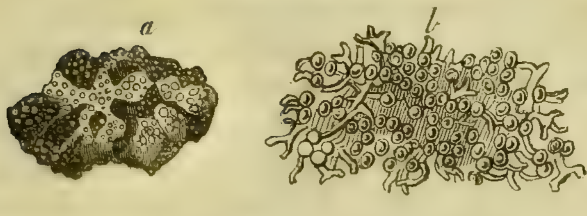
The opacity of the filaments prevents the articulations being easily seen in these plants.

nema, *Trentepholia*, and *Leptomitus*, should be retained in this group seems very questionable.

(416.) *Byssöidaceæ.* Various apocryphal vegetable productions in which neither spores nor sporidia can at any time be traced, and which, although probably in some cases, the abortive or rudimentary states of decided *Byssines* cannot be referred with certainty to any known genera, are associated, to close this section, in a type denominated the *Byssöidaceæ.* These are the *Byssaceæ spuriæ* of Fries; and among them will be found the doubtful genera *Lepraria*, *Tophora*, *Phyllerium*, &c. which are examples of the three groups into which the German Lichenologists distribute them, and which might hence, were such distinctions needed, be named the subtypes *Lepraridæ*, *Tophoridæ*, and *Phylleridæ*.

(417.) Of the doubtful nature of the *Lepraria* or *leprous-worts*, notice has been already taken; and of several of the species once included in this genus, such as *latebrarum*, *æruginosa*, *Iolithus*, and *chlorina*, Greville, in his Flora Edinensis, observes, "I confess myself at a loss to know what to do." The first, however, which he acutely observed, even in 1823, was not a Lepraria, Fries has shewn to be the early state of a *Cladonia*, and the same fate has befallen *æruginosa* and *velutina*. The Lepraridæ are, therefore, now confined to those asporous *Byssöidaceæ*, which arise on, and from, the dead and decaying structure of various plants.

Alyspheria (Lepra) candelaris.



(*a*) Natural size. (*b*) Portions magnified to shew its hypothalline form.

(418.) The *Byssus cryptarum,* of old writers, is the present *Tophora,* which, with certain threadlike productions, not epiphytic, but found on the bare soil, and formerly confounded with *Byssus velutina,* but now distinguished by the name of *Herpotrichum,* forms the subtype *Tophoridæ.* The colour of the Tophoridæ is usually green. They are asporous, and by some supposed to arise from the germination of the spores of Ferns and Mosses being arrested in their rudimental states. *Byssus velutina,* as already observed, has been proved to be the infant stage of *Polytrichum Alöides.*

(419.) Whether *Chlorococcus* (or Chlorococcum), *vulgaris, murorum,* &c. should be separated generically from the *Lepraria,* is

Chlorococcum vulgare.

(*a*) Natural size; on wood.

(*b*) Group of plants magnified.

(*c d*) Ditto, removed from the wood, and magnified to shew their simple cellular structnre.

a question of slight importance; so that the species are situated near each other, it little matters whether two genera are made, or the whole be re-associated in one. They are usually kept distinct, but by Hooker, I perceive, they are conjoined: they are some of the simplest plants existing, being, in the air, what the *Globulinaceæ* are in the water: thus connecting the extremes of

this extensive class. They abound on old palings, damp walls, the trunks of trees, and other similar situations [§ 41.]

(420.) Several folliculous or leaf-dwelling epiphytes, more or less abounding on living leaves, especially the maple, pear, alder, birch, walnut, hawthorn, rose, &c., the growth of which is favoured, if they themselves are not wholly produced, by a degenerate evolution of the cellular structure of the plants on which they are found, are associated to form the third subtype of the *Byssöidaceæ ;* and, from their habits, they have been called the *Phylleridæ*, (or Phylleriaceæ.) Sometimes the whole of these plants, from their prickly erinaceous appearance, have been included in a genus called *Erineum*, but at others they have been distributed into several subordinate groups, *e. g. Phyllerium*, *Erineum*, or *Grumaria*, and *Taphria*, the origin of which last is said by Fries to be dependent on meteoric changes.

(421.) Pseudo-Byssöideæ. As an appendix to the *Bysso-lichens*, and being on the confines of the organic and inorganic realms, cryptologists enumerate several Byssus-like productions, under the names of *Hypha*, *Lanosa*, &c., and call them collectively *Byssaceæ falsæ*. These pseudo-Byssi seem to be chiefly of meteoric origin and atmospheric growth. Occasionally they occur in vast profusion, and their advents are irregular and sudden. The *Lanosæ* are those subfugacious filaments resembling the lines of spiders' webs, and the *Hyphæ* similar productions, but much more speedily deliquescent and found chiefly in damp caves and cellars, while the others are most frequent in the open air.

(422.) One sort of honey-dew, it is even thought, may be owing to the deposition of similar meteoric subvegetations, or, perhaps, to be the abortive phyco-matrices of various Byssine Algæ, the vitality of which has been destroyed by atmospheric changes. Several of the more remarkable visitations of these meteoric or pseudo-Byssöidaceous productions have been placed on record, from time to time, as they have occurred. One of these was noticed in Germany, in the month of April, 1709; another at Dresden, in August, 1751; and others in Bohemia, and various distant places. And it is furthermore a question, whether the appearance of some of the so-called falling stars, and many other meteoric lights, may not be owing to the phosphorescence or electrical combustion of these aërial formations, whether they be of vegetable origin or not.

(423.) Here closes the third and last section of the Lichenales,

and with it the first class, *The* FLAGS, or ALGÆ; a very extensive and a very important class. Reducing the Lichenales to a similar tabular conspectus with the two preceding orders, the following will be the form of their linear arrangement:

ORDER.	*Sections.*	*Types.*
LICHENALES	Cetrariuæ.	Parmeliaceæ.
		Graphidaceæ.
	Verrucarinæ.	Pertusairaceæ.
		Verrucariaceæ.
	Bysinæ.	Rhizomorphaceæ.
		Byssaceæ.
		Byssöidaceæ.
	Pseudo-Byssöideæ.	

GEOGRAPHICAL DISTRIBUTION OF THE LICHENALES.

(424.) The distribution of the Lichenales chiefly assumes a topographical rather than a geographical interest. This will already have become apparent from the notices of stations so frequently introduced, and by which they have been shewn to become such admirable guides in the distinction of some of the officinal barks; and moreover, indexes of the states of their preservation: their general statistics will be found, however, not wholly unworthy of attention.

(425.) The whole number of known species of this order has been estimated by Fee at between two and three thousand. This, however, is probably too high a sum, even including the Byssinæ, many computed by him being only varieties.

(426.) Geographically considered, they are, in the first place, aerial plants, and their range is most extensive: proceeding either from the poles, or descending from the polar heights of hills, they are found to be first heralds of life, encroaching even on the confines of perpetual snows, vegetating at a temperature below the freezing point; and they cease not to struggle against every impediment to vegetable growth, for they flourish even among the burning sands of *Africa*, and in the hottest and driest regions of the torrid zone. Wherever light comes Lichens grow, but they are rarely produced in obscure places. When deprived of light, they degenerate in their forms, and it is the lowest section only, viz. those approaching to the Fungi, that vegetate in the dark. So little is heat regarded by these plants, that when utterly parched by months of drought, they revive when rain returns; and even if hot water be poured over them, they are not destroyed. Heat seems rather to favour the development of their fructification, for in the hottest and driest places their apothecia the most abound.

(427.) With regard to the general geographical distribution of the European Lichens, and no others have been hitherto studied with sufficient minuteness to allow generalizations to be made, Fries gives the following summary account. In the southern parts of Europe, on the shores of the Mediterranean Sea, there are found several species of tropical genera, which likewise occur in the warmer regions of America; such as *Chiodecton* and *Dirina.* From this southern district, it is believed that other more northern Lichens are absent; such as *Parmelia tartarea*, the *Umbilicariæ*, &c.; while *Evernia villosa*, *Ramalina pusilla*, *Cladonia endiviæfolia*, and many *Parmeliæ*, are present. The *Graphidaceæ* are also here abundant.

(428.) Along the whole western coasts of the Atlantic, even from the south of Spain to Finmark, many of the same Lichens are common; such as Ramalina scopulorum, and various Strictæ and Parmeliæ: the moist atmosphere and more agreeable temperature of a maritime station favouring the extended range. This tract, however, may be subdivided into northern and southern regions: in the latter, the *Roccella tinctoria*, *Sagedia aggregata*, and numerous *Verrucariæ*, and *Graphidaceæ* are found; in the former, *Parmelia gelida*, *Biatora atrorufa*, and the *Umbilicariæ*, predominate.

(429.) In the Arctic regions, as in Iceland, and especially in the Alpine parts of Lapland, the *Cetrariaè* and *Cladoniæ* prevail: the former flourishing on the tufa and volcanic scoriæ; the latter clothing an otherwise barren soil, even from the sea-shore to the summits of the mountains. In these districts, *Evernia vulpina*, and many other Lichens, cease to grow; as the Calicia do in warmer regions: for Fries observes, that in the tropics, these last-named Lichens are unknown. *Usnea barbata* and *Cladonia pyxidata*, and a few others, are quite cosmopolites, for they occur in almost every region.

(430.) Thus it will be perceived, that the Phyco- and Myco-Lichenes, *i. e.* the *Verrucarinæ*, with a large proportion of the *Byssinæ*, although not confined to, predominate in the southern parts of the temperate zone; while, on the contrary, the Bryo-lichenes, *i. e*, the *Cetrarinæ*, become most abundant in those regions that verge towards the pole.

(431.) Fries observes, that the *Verrucarinæ* are so numerous in the southern regions, that it would almost seem as if the excess of heat had driven the tribe to take refuge under the epidermis of

trees. As vegetation is far less luxuriant towards the north, it is not surprising that Epiphytic Lichens become rare, and at last wholly cease, in more and more northern regions, and on the northern altitudes of hills; and that the saxicolous species, in a great measure, characterize, by their abundance, the Arctic zone. Although the geographical range of the Lichens is thus most extensive, spreading as they do over the whole earth, from the equator to the poles, still they would seem on the whole to be plants rather of the northern than of the southern regions, for their numbers gradually increase, not only relatively, as compared to other plants, but positively also, in the higher latitudes, until at length they remain alone—the last which yield to the exterminating power of cold. The properties, likewise, which they possess, seem to be more fully developed in the northern than in the temperate and torrid zones.

(432.) As to special stations, the utmost variety prevails: they grow on the trunks of trees, on their leaves, on dead wood and stones of the hardest kinds, Biatora decipiens is said even to vegetate on iron; and others, as the Byssocladium fenestrale, spread their fibres over glass. Many of these stations have been already noted, and their topographical interest is great.

(433.) The physical services of the Lichens also, in overspreading sand, volcanic scoriæ, ashes and lava, in disintegrating rocks, and first planting Flora's standard on tracts thus claimed, and subsequently colonized by plants of other tribes, which follow the footsteps of these vegetable bond-slaves, should never be overlooked. In the general introduction [§ 54,] these circumstances have been described. Instead therefore of repeating what has been already said, the following quotation from one of nature's truest poets, may recal the subject to the reader's mind:

> "Seeds to our eyes invisible, will find
> On the rude rock the bed that fits their kind;
> There in the rugged soil they safely dwell,
> Till showers and snows the subtle atoms swell,
> And spread the enduring foliage; then we trace
> The freckled flower upon the flinty base;
> These all increase, till in unnoted years
> The stony tower as grey with age appears,
> With coats of vegetation, thinly spread
> Coat above coat, the living on the dead:
> These then dissolve to dust, and make a way
> For bolder foliage, nursed by their decay:

The long-enduring Ferns in time will all
Die and depose their dust upon the wall;
Where the winged seed may rest, till many a flower
Shews Flora's triumph o'er the falling tower.

CRABBE.

(434.) Although the *Lichenales* have so wide a geographical range, being spread over the whole surface of the globe, from the Tropics to the Poles, not a single specimen has hitherto been found in a fossil state. This confirms the conclusion which the occurrence of the *Marine* Algæ in the older strata supports, viz. the prevalence of the waters over the surface of the globe during a certain geological epoch. Lichens, which are aërial plants, being saxicolous or chiefly epiphytic, of course, could not exist before the rocks were raised from the bosom of the deep, or plants were growing on the land. The stone-dwelling Lichens would probably be the forerunners of the other tribes; but their very minute size and pulverulent structure may sufficiently account for not any traces of them having hitherto been found. And the remains of trees, and other land plants, which abound in the coal formations, and in the tertiary series, are, for the most part, so much injured, their stems compressed, their leaves separated, and their different parts often so greatly dismembered and disguised, that it is not to be wondered at that no relics of Lichens have been discovered on them, or their impressions distinguished from the natural or accidental markings with which such specimens are overspread.

(435.) This outline sketch of the natural history and systematic arrangement of the Algæ may perhaps be best concluded, by reducing the whole three orders the class contains to the form of a tabular conspectus, similar to those in which the several types and sections have been synoptically disposed.

CLASS.	*Orders.*	*Sections.*
ALGÆ	Lichenales.	Byssinæ. [400. 405. 411. 416.]
		Verrucarinæ. [393. 395. 397.]
		Cetrarinæ. [362. 377. 386. 387.]
	Fucales.	Fucinæ. [249. 264. 267. 268. 270. 276. 290.]
		Florinæ. [249. 251. 253. 255. 261. 262.]
		Ulvinæ. [239. 243. 244. 246.]
	Confervales.	Confervinæ. [178. 189. 195.]
		Nostochinæ. [137. 152. 154. 155.]
		Fragillinæ. [136. 140. 142.]

NOTE.—The figures refer to the sections in which the associating characters of the several groups and subdivisions will be found.

OUTLINES OF FUNGOLOGIA.

(436.) Several extensive groups of very extraordinary plants, many of which are known familiarly as Blights, Blasts, Mildews, and Mushrooms, are associated to form the second class of the first region of the vegetable reign; and they are collectively denominated Fungi.

(437.) Many doubts have been entertained as to the exact nature of these plants, some persons, as Scopoli, Weiss, and Büttner, believing them not to be vegetable, but animal productions; while others have denied that they were either; and have not scrupled to describe them as the fortuitous effects and offspring of corruption. Other naturalists, again, have considered them as beings of so peculiar and distinct a kind, that they have formed them into a separate kingdom, holding an intermediate rank between the animal and vegetable reigns; and Munchausen once contended that, although neither animals nor plants, they were the work of insects, and built up by them as corals are by polypes.

(438.) But all these speculations have been shewn to be based on error, and no one now denies that Fungi are truly plants. Many fungöid diseases to which leaves and stems are subject, and morbid growths, which are common to all parts of vegetables, must, however, be excluded; for, notwithstanding they have been named and arranged as fungi by some celebrated Mycologists, they have no right to be considered such, any more than the chemical changes attending putrefaction, which are likewise contemporary with the growth of fungi.

(439.) Fungi and insects have not inaptly been called 'the scavengers of nature,' for both labour, and with most astonishing effect, in the removal of refuse matters, which, were they left on the surface of the earth, would be found not only useless incum-

brances, but injurious tenants. The fungi are for the most part parasitic plants, and chiefly grow on dead and decaying animal and vegetable substances. These they help to disintegrate and dissolve, and speedily remove, converting the exuviæ of one generation into manure and vegetable mould, for the support and sustenance of the next. For these duties their minute seeds and wandering habits, [§ 55, 57,] particularly suit them. The vapour-like sporules of fungi float about in the atmosphere in countless myriads, only waiting for the presence of a fitting soil on which to alight and grow. By an admirable law, it is provided that these vegetable legions are confined to parasitic soils, and hence, as long as there is no refuse matter to be removed, the spores remain dormant, (the scavengers are unemployed;) but as soon as ever a quantity, be it large or small, of decaying animal or vegetable matter is left exposed, so soon is it covered with spores, which quickly develop themselves into fungi of various kinds. Owing to their rapid growth, fungi have been said to be never in their nonage, but to spring at once to maturity, and almost to enter the world full-grown; which, added to their astonishing fruitfulness, renders their history one of peculiar interest. Each individual of those minute fungi which are only noticeable when in legions, and which are known as smut in corn, has already been stated to produce, according to the calculation of Fries, upwards of 10,000,000 sporules; and other species have been proved to grow at the rate of between sixty and seventy million cells per minute.

(440.) Hence, what has been said of their fellow-labourers, insects, will apply with equal truth and force to these nomadic tribes; and therefore Lyell's statement of the question shall be quoted with only a few slight verbal alterations. "The peculiarity of their agency consists in their power of suddenly multiplying their numbers, to a degree which could only be accomplished in a considerable lapse of time in any larger beings, and then as instantaneously relapsing, without the intervention of any violent disturbing cause, into their former insignificance.

"If, for the sake of employing on different but rare occasions a power of many hundreds or thousands of horses, we were under the necessity of feeding all these animals at great cost in the intervals when their services were not required, we should greatly admire the invention of a machine, such as the steam-engine, which

was capable at any moment of exerting the same degree of strength, without any consumption of food during the periods of inaction, and the same kind of admiration is strongly excited when we contemplate the powers of insect and fungus life, in the creation of which nature has been so prodigal. A scanty number of minute individuals, only to be detected by careful research, and often not detectable at all, are ready, in a few days, or weeks, to give birth to myriads, which may repress or remove the nuisances referred to. But no sooner has the commission been executed, than the gigantic power becomes dormant; each of the mighty host soon reaches the term of its transient existence; and when the fitting food lessens in quantity, when the offal to be removed diminishes, then fewer of the spores find soil on which to germinate; and when the whole has been consumed, the legions before so active, all return to their latent, their unnoticed state; ready, however, at a moment's warning, again to be developed, and, when labour is to be done again, again to commence their work, either in the same districts, or to migrate in clouds, like locusts, to other lands. In almost every season there are some species, but especially in autumn there are many, which in this manner put forth their strength; and then, like Milton's spirits which thronged the spacious hall, 'reduce to smallest forms their shapes immense:'

> "So thick the aëry crowd
> Swarmed and were straitened; till the signal given,
> Behold a wonder; they but now who seemed
> In bigness to surpass earth's giant sons,
> Now less than smallest dwarfs."

(441.) Fungi have been very variously distributed, and the subordinate groups very variously named; and it is to be lamented, that much doubt and uncertainty still exists as to the extent of the several groups, and the boundary-lines by which they should be demarcated. Different Mycologists greatly differ in their arrangements, but they all more or less agree with the popular distribution into *Blights*, *Puff-balls*, and *Mushrooms*. These are then the groups which will be adopted in the subsequent demonstrations.

(442.) In the first of these three orders are arranged the Blights, Blasts, Brands, and Mildews, some of the smallest, and yet, from their numbers, some of the most powerful and destructive fungi known. They have been called MUCEDINALES, from Mucedo,

mouldiness, or Uredinales, from *Uredo,* the Brand; and sometimes, from their sporidia being naked, *Gymno-mycetes;* thus including the Coniomycetes of Fries and other authors.

(443.) In the second order will be found the Puff-balls, Ground-stars, and Truffles. Hence they are called, collectively, from Tuber, the Truffle, TUBERALES; or by some Mycologists *Gastromycetes,* from the reproductive organs being enclosed in a ventricose pouch. Some of the tuberiform fungi grow to a most amazing size, being two or three feet or more in diameter, so that such large rounded masses of a tawny colour have been mistaken by travellers, in tropical countries, for couching lions.

(444.) The third order contains the well-known eatable Mushrooms, and many poisonous species, which are commonly designated toadstools. This group is called BOLETALES, *Mycetales,* or Hymenomycetes. It is probable that it was to the plants contained in this order that the original Greek *μύκης*, like the modern French champignon, was particularly applied: as, in reference to the common form of the plants, both terms are peculiarly appropriate, resembling, as many of these fungi do, the handle of a sword, and others, the pinion of a watch.

(445.) These three orders, into which the subordinate types and sections are associable, are not, however, three widely separated groups, but only diverse portions of one entire though extensive district; all as it were setting out from a common central point, at which they are intimately connected, though pursuing, in their development, very different courses. Hence is it that the plants constituting mustiness, mouldiness, and mildew, though all different, and some of them belonging even to different orders, are confused in popular examinations, and undistinguishable by the untutored eye.

(446.) There is something very peculiar and characteristic, though scarcely expressible in a few words, in the general aspect of the fungi. They are destitute of most of the external organs which are common to other plants; they have neither flowers nor leaves, nor any members which shew the slightest resemblance to them; and even their stem, when present, is unlike the stem of other plants.

(447.) In their colouring everything is reversed. Green, which in general so greatly predominates, among them is rare, and when it does occur, as in *Peziza æruginosa,* it is a lurid metallic tint,

wholly at variance with the soft green hues of ordinary foliage. Colours of the most shewy and brilliant kinds are common amongst the fungi; and so splendid are the tints, as compared with those even of many flowering plants, that, as Dr. Flemming truly observes, in colouring figures of the fungi, there need be little apprehension entertained of committing excess; while, in the coloured drawings of the more perfect plants, the artist is sometimes too profuse in tints, and the figures exhibit a gaudy appearance, which offends the eye, as it swerves from truth. Nature having withheld from fungi those flowers which form the chief beauties of the higher orders, and even the leaves with which they are clothed, has profusely scattered her colours over the whole surface of the mushroom, ornamenting the cap with one colour, the gills with a second, the stem with a third, and often blending in stripes, or shading two or three tints into each other; as in Agaricus psittacinus, Amanita imperialis, and others.

(448.) Hence, let the lover of natural history but free his mind from prejudice, and then examine the forms and colouring of these far too much-neglected plants, and he will be compelled to admit that many of the fungi rival, in symmetry and splendor, the tulip and the lily, those gaudy favorites of the world at large.

(449.) As was the case with the Algæ, several doubtful fungöid productions form one of the acknowledged boundaries of this class, such as the fungus-like matter found amongst fermenting grain, which has been called *Spermoedia*, and various morbid states of plants in which the cellular structure extrudes, forming sometimes closed, and sometimes open tumors. These, however, though once considered fungi, are now recognised as diseases, or their effects; and other doubtful fungi will probably hereafter meet a similar fate.

(450.) Fungi, especially of the smaller kinds, are found to spring profusely on mucous or slimy matter, such as exudes from trees when wounded, and is likewise seen in other situations; hence, as it forms a nest or nidus for the reproductive organs of the fungi, (which are collectively denominated Mycelia,) it has been called the Myco-mater, a term analogous to the Phyco-mater of the Algæ.

(451.) The pseudo-mycetes, (false fungi) *Spermoedia*, *Strumella*, *Nosophlœa*, &c., are analogous to the pseudo-byssöideæ, *Hypha*, *Lanosa*, &c., and are placed, like them, in an appendix; not being

admitted to be truly fungi, although connecting the organic with the inorganic world. And the *Myco-mater*, though possessing a similar name, is not a production equivalent to the *phyco-mater* of the Algæ, as it is merely an adventitious nidus, and not in any case produced by the degeneration of the mycelia, or rudiments of fungi. Indeed, the chief distinction between the lower Algæ and Fungi, especially between the conterminal sections *Byssinæ* and *Uredinæ*, will be found to depend upon the relative evolution of the thallus or organ of extension, and the *sporidia*, or special organs of reproduction.

(452.) In the Algæ the *thallus* is always present, and often, by division of its substance, furnishes the reproductive germs for the propagation of the species; the spores being frequently abortive, or altogether wanting, while, in the fungi, the sporidia or spores are as universally present, although the thallus is often absent, the plants consisting of the reproductive organs only.

(453.) Thus, the evolution of the Algæ and the Fungi would appear to take place on directly opposite principles, in the one the thallus, in the other the spores, being with the most certainty developed; and hence the dogma that, as the *thallus* is essential to the *Algæ*, so the *sporidia* or *spores* are essential to the *Fungi*.

MUCEDINALES.

MUCORALES, OR UREDINALES.

(454.) The first order in this class, which, from either of the three most important genera, *Uredo*, *Mucor*, and *Mucedo*, might be called indifferently *Uredinales*, *Mucorales*, or *Mucedinales*, includes all those fungi which either consist of sporidia alone, unconnected by any common receptacle (thallus), or in which the sporidia are unaccompanied by any of those organs subsequently to be described under the names *hymenium*, *perithecium*, and *peridium*.

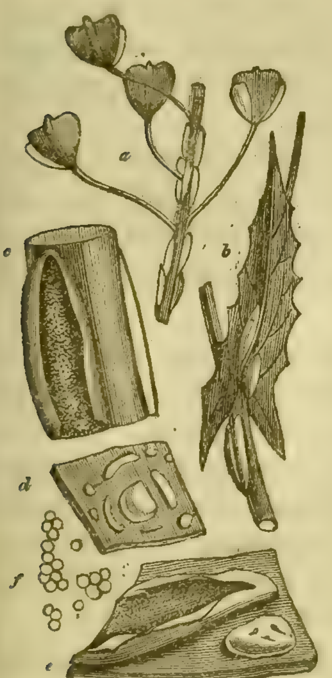
(455.) Hence these fungi have by some been called the *Gymnomycetes;* but sporidia really naked rarely occur among the fungi. A few are absolutely destitute of any covering, but others, although possessed of no true tunic, take an adventitious one in their early stages of development from the cuticle of the plants on which they grow, and through which they burst. Occasionally, even prolongations of the receptacle form a fugacious tunic.

(456.) The order *Mucedinales* is equivalent to the cohort *Coniomycetes* of Fries; the *Hyphomycetes*, which by most authors are retained amongst the fungi, I am persuaded, have with propriety been removed, by the above-named celebrated Cryptologist, to the Bysso-Lichens: and they have been already described, along with their true associates, the other Lichenales.

(457.) But although arranged in different classes, the Myco-Lichens and the Mucedinales, which are on the confines of the two departments, are more closely connected, and have more characters in common than any other orders; and here the principle so often insisted on may be again repeated, that, in the distribution of the natural groups of the vegetable world, it is not only their distinctions, but their connexions, which should be diligently sought out.

UREDINÆ.

(458.) Uredinaceæ.* *Uredo*, the Brand; [§ 458, fig. 469.], *Æcidium*, the Blast; *Puccinia*, the Blight, [§ 469, fig. I, J, K.] with other allied genera, constitute, together, the type *Uredinaceæ*. The



(*a, b*) *Uredo candida* on the stalk and leaves of Capsella Bursa pastoris.

(*c*) Portion magnified, showing the false tunic, formed of the integument of the Capsella, burst and exposing the sporidia.

(*d*) *Uredo candida* on a cabbage leaf, before rupture.

(*e*) After rupture.

(*f*) Sporidia magnified.—*Grev.* 251.

* Fries called this type Hypodermii; but he states his opinion, in a note, that the name ought to be changed for one derived from some normal genus.

group is distinguished by each plant consisting of a sporidium only, and by these sporidia, although often associated in myriads, not being connected by any common receptacle. They grow in the parenchyma of living plants, the epidermis of which forms for them, during their early stages, an adventitious tunic, through which they burst in the progress of their development. [see § 458, fig. D. E.]

(459.) *Blight*, like *Brand* and *Blast*, is a term which has been popularly applied to all these small fungi, indifferently, and is indicative of the former opinion, still entertained by many, that the plants affected by them have been star-struck, burned, or blasted by some atmospheric or planetary influence; names which were given in ignorance, thus being retained long after the error has been detected, and the truth revealed.

(460.) The different species of *Puccinia*, or *tuft-blight*, are exceedingly common on the leaves of various plants; such as roses, violets, and brambles, as well as on grasses and sedges, from which parasitic situations they generally take their names: *e. g.* Puccinia graminum, [§ 459, fig. I, J.], P. phaseolarum, P. rosæ, &c. &c. The leaves affected are frequently studded so thickly with the Pucciniæ, collected into their elegant little tufts, as more than to compensate, by the additional beauty they confer, the apparent injury they inflict upon the plants.

(461.) *Cylindrosporium* is a beautiful and very curious fungus, consisting of distinct cylindrical sporidia. It is found upon the leaves of the common cabbage, and, from the fungi being all elegantly arranged in concentric circles, it has received the name C. concentricum.

Spilocæa, and *Nævia*, allies of *Cylindrosporium*, afford, with it, as to structure, examples of the simplest fungi known; the last consisting only of elongated sporidia collected into circles, and the first of similar simple subglobose sporidia, crowded into larger or smaller groups, and forming the spots, usually of a black colour, which are common on apples, and other fruit. When the sporidia are solitary, so that only small black dots are visible, they have received the name of *Næviæ*.

(462.) Æcidium, the blast or dust-blight, is likewise another very common fungus, parasitic on living plants. It abounds on the leaves of the colts-foot, gooseberry, berberry, &c. For the most part, the species are of a bright orange or reddish brown

colour, and thus add much to the variety and beauty of the leaves on which they grow.

These, as well as other parasites, are most curiously restrained as to the plants which they attack; for, while some vegetables are annually infested with Æcidia, others are invariably exempted from their attacks. The circumstances which determine this choice are, as Johnson observes, entirely unknown. Examples of this liability and exemption occur even in the same genus; thus the gooseberry bears æcidia in abundance, while the red and the black currants, although cultivated in the same soil and situation, remain free from their attacks. This is the more remarkable, because, though the currants are decidedly indigenous plants, the gooseberry is a very doubtful aboriginal native.

(463.) The most important genus in this type, and indeed in the whole section, is the *Uredo*, so named from *uro*, to burn, as the corn affected by some species appears as if scorched, and the husks contain a black powder resembling soot or charcoal. There are many species of Uredo, all of which are closely allied to the Æcidia, of which latter group they are, by some authors, considered a subdivision. From the Æcidia they are, however, sufficiently distinguished by the irregular rupture of their *false tunics*, (*pseudo-peridia*,) [§ 458, *c*, *e*,] which, as before observed, are furnished by the cuticle of the plants on which they grow. Fries likewise states that the pseudo-peridium, which in the Uredines consists of the epidermis only, is in the Æcidia thickened by the elevation of a part of the parenchyma also.

(464.) The Uredines are of different colours, and hence several subordinate groups have been attempted to be formed, called *Albugines*, *Rubigines*, and *Nigredines;* but their generic distinctions have not been satisfactorily established.

Most of the species of Uredo are common, and they are found upon a great variety of plants, such as the Compositæ, Labiatæ, Rosaceæ, Cruciferæ, Gramina, and many others; but those which, above all, are the most fatally interesting, are the *smut* (*Uredo segetum*, or *carbo*,) and the *canker-brand* (*Uredo caries*, or *fetida*.)

(465.) These plants, which, in the general economy of nature, are designed to effect much good, in checking the over-predominance of certain species, which, if unrestrained, would extirpate others less hardy and vigorous than themselves, when they attack corn-lands, often commit most fearful devastations. Indeed, they

become pests, which keep the farmer in a constant state of agitation; for, so insidious are their advances, that large tracts are laid waste, and the harvests of the year annihilated, before a suspicion of harm has entered the owner's mind.

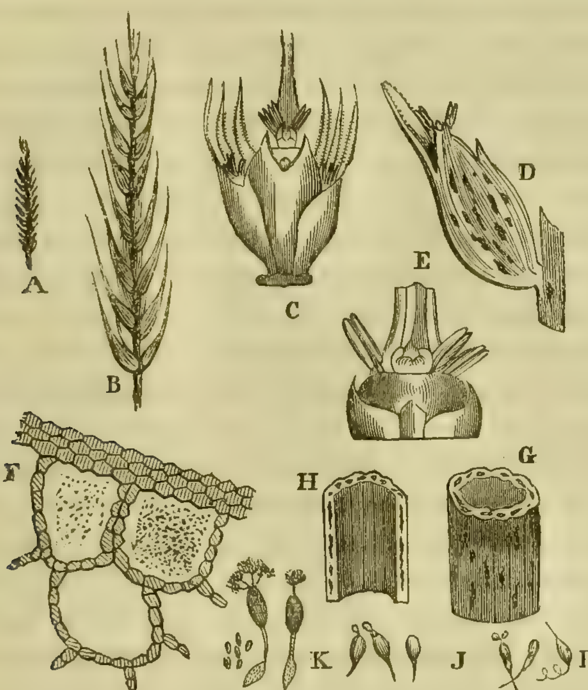
(466.) The eye of science, it is true, will often be enabled to detect the evil in an early stage, by the unusual size and luxuriance of the diseased culms, which frequently exceed in stature, and to a very considerable extent, the healthy stalks, which spring either from the same root, or from contiguous plants. This fatal luxuriance, which deceives the untutored boor, is attributable to the constant excitement which the fungi keep up, and the preternatural state of stimulation in which the growing corn exists. Some persons have accounted for the excessive growth by supposing that the fungi chiefly attack plants growing in the richest and most fertile soils; but similar differences are found not only in plants growing in the same field, but in the several culms springing from the same root.

(467.) There are two species of Uredo, which the farmers, in different districts, call smuts, brand-dews, dust-brands, scorch-blasts, brand-bladders, pepper-brand, canker-brand, burnt corn, &c. The one, *Uredo segetum*, the smut or dust-brand, attacks all the cereal grasses, such as wheat, oats, barley, rye, &c.; the other, *Uredo fetida*, canker-brand or brand-bladders, has hitherto been found on wheat alone.

(468.) The late Sir Joseph Banks instituted a laborious series of observations and experiments, to elucidate the obscure history of these extraordinary parasites; and he engaged the invaluable microscopic hand and eye of Mr. Bauer, to assist him in prosecuting these researches. The drawings then made are deposited in the British Museum, and the last-named naturalist has lately published some excellent figures of both species, with a condensed account both of his former and subsequent observations.

(469.) Mr. Bauer is of opinion, with Fee and others, that the spores of the Uredines, which are of extreme minuteness, (Fries says, as subtile as smoke,) are absorbed by growing grasses, and other plants on which they are found, along with the fluid nourishment they derive from the soil; and experiments, in which the spores of the Uredines were mixed with the soil, and sound wheat subsequently became diseased, have proved the truth of the opinion. The spores, thus conveyed through the sap-vessels of the plants,

pervade their most intimate structures, and, when lodged either in the parenchyma of the stem, or of the ear, prevent the growth of those parts. At first, the stimulus, like the puncture of insects, excites to undue and precocious development; but subsequently, instead of the normal metamorphoses taking place, the several organs remain abortive in their earliest forms, (as shewn in the adjoining figures,) and the cellular structure becomes distended by innumerable fungi.



A. Young ear of barley, natural size, affected by *Uredo segetum.*

B. Ditto, fully grown, before the dispersion of the Uredo; natural size.

C. Three flowers, springing from a common axis, taken from the ear A, and viewed internally.

D. Longitudinal section of the central flower of fig. C: shewing the common axis of the ear; external, internal glume, or husk; axis of the spikelet or peduncle of the flower, filled with sooty-like matter of the Uredo; abortive stamens; abortive ovary.

E. Summit of the same degenerate mass, occupied by the abortive stamina and pistils.

F. Transverse section of a part of the degenerate fleshy mass, shewing the smut. Epidermis, shewing dissepiments between the spaces, which are filled with the granules of Uredo segetum.

G. Transverse section of the culm, shewing the devastations of these parasitic fungi.

H. Longitudinal section of ditto.

I. Puccinia graminum.

J. Puccinia phaseolorum.

K. Puccinia mucronata, with the sporidia escaped.

(470.) It is a fact worth notice, that when, as is usually the case, many culms (twenty or thirty) spring from the same seed, they are not commonly all diseased, but some remain healthy, while others are infested with the parasites; and again, that even in the same spike, or spikelet, some grains are diseased, and others sound.

(471.) The Uredo segetum and Uredo fœtida are easily distinguished from each other, not only from the difference in their size, (the latter being at least twice as large as the former,) but likewise from their essentially diverse methods of attack. The canker-brands are like a troop of sappers and miners, who carry on all their operations secretly, and often complete their work before its commencement has been suspected. Thus, while externally the ears look fine and sound, and the husks healthy, so that they are often reaped and housed, the whole farina of the grain has been consumed, or aborted, and its place usurped by a greasy, sooty-looking substance, which swells them beyond their ordinary size, and which has a most powerful and fetid odour, resembling that of putrid fish; so that, if threshed with sound corn, the sample is considerably injured, and, if in any quantity, rendered unfit for food.

(472.) The smut, on the contrary, soon becomes evident externally; for its attacks are not confined to the grain, but it equally affects the husks, leaves, and culms. Hence it distorts the entire plant, which becomes more or less shrivelled up, as if scorched and dusted over with charcoal; for the Uredo segetum quickly bursts, and discharges the sporules; whereas, the Uredo fœtida seldom ruptures the teguments of the grain, and thus it remains concealed until the corn is threshed. Furthermore, the smut (U. segetum) is scentless, while the canker-brand (U. fœtida) gives out, when crushed, a most intolerable stench.

(473.) It has been said that Uredo fœtida is double the size of Uredo segetum [§ 471,] but, although this is the case, both plants are extremely small. Of the largest, Bauer computes that "no less than two millions five hundred and sixty thousand individual fungi would be required to cover one square inch;" and that of the other "no less than seven millions eight hundred and forty thousand would be required to cover a similar space." Furthermore, Fries has calculated that each of these fungi contain upwards of ten million spores; an approximation, even amongst living organisms, to an infinite division of matter. When highly magnified,

the maternal tunic, which contains the myriads of sporules just mentioned, is seen to be of a reticular texture, and the spores within have the appearance of cellular structure.

(474.) Very numerous schemes have been devised, and many plans tried, with variable success, in order to restrain the devastations of these fungi, if not entirely to extirpate such fearful pests.

In ancient times, when the true nature of these visitations was unknown, religious ceremonies were chiefly resorted to for the purpose of averting the presumed anger of heaven, or of appeasing a supposed offended deity. The Romans, in consonance with their established customs, deified the cause of their distress, and, after the apotheosis of the brand, it was worshipped under the name of RUBIGO. The *Robigalia* were propitiatory sacrifices and feasts instituted in honour of the god: they were held the beginning of May, at which time Rubigo was besought to let the corn escape his fearful blasts. Since, however, the true nature of these blasts and brands has been discovered, men have laboured to ascertain the physical conditions which favour and retard the propagation of these destructive parasites; and the result has shewn that here, as elsewhere, they should strive to help themselves, if they desire that heaven should help them.

(475.) "Mr. John Woolnough, of Boyton, sowed a large field, in alternate breadths, with wheat taken from a good sample, without dressing, and wheat that had been dressed in the usual manner. Long before the corn was ripe, the difference was most distinguishable. Upon those stretches sown with dressed wheat, it was difficult to find any branded ears; while the others were so branded as to make him determine to carry the corn at separate times to different places." [*Lin. Trans.* v.]

(476.) Other experiments shew that very careful washing with plain water is equally efficacious, though more troublesome than the use of more expensive means; but lime appears to have been found, on the whole, to afford the most manageable and least costly dressing for wheat. Mr. Bauer, who has performed many experiments on this subject, confirms the statements of other less scientific investigators. He gives it as his opinion that "lime-water destroys the vitality of the spores of both Uredo fœtida and Uredo segetum, and therefore he recommends seed-corn to be steeped in that solution." As the spores of the fungi are, however, often scattered in vast abundance over the soil before the

corn is reaped, and are there ready to infect the sound or prepared grain, it is also well to use lime as a manure, or, at any rate, to have a moderate quantity sprinkled over the fields, which, when dissolved by the rain, or washed into the soil, may destroy the spores of the Uredines which have been shed in the fields, as dressing the corn may free it from those which were carried with the grain.

(477.) The experiments of Sir Humphry Davy upon the nutritious properties of vegetables in various states, fully warrant the anxiety which farmers evince to keep their corn-fields free from blight and mildew, as these brands, or their effects, are usually called; for he has shewn that a thousand parts of good Middlesex wheat yield, on analysis, 955 parts of nutritious matter, and a thousand parts of spring wheat nearly as much, viz. 946 parts; while the same wheats, when blighted, yield from each thousand parts only 650 of nutritive matter, and, if much mildewed, only 210. So that, without calculating the injury to taste and colour, the absolutely nutritious portion is reduced to less than a quarter, nay, to little more than a fifth, of what is contained in healthy wheat.

(478.) The experiments of Fee upon the production of these minute parasitic fungi are extremely interesting, and, as running parallel with those of Bauer, must be considered quite satisfactory. Having collected some leaves of a Rosa centifolia, which were entirely covered with Uredo rubigo, he took three rose-trees of the same species, the leaves of which shewed no trace of Uredo, and, having put them in separate boxes, removed them from the neighbourhood of the affected plant, but still kept them in a similar aspect. One part of the rose-leaves covered with the Uredo was mixed, towards the end of the winter, with the mould in the box of one of the rose-trees, and the remainder subsequently used in the manner immediately to be detailed. When the second rose-tree was in full vigour, and near blossoming, some of the affected leaves were frequently shaken over the soil, to detach the seminules of the fungi, the remaining portion of which continued attached to the leaves. The branded rose-leaves were then steeped in water, and the third rose-tree watered with the mixture, during the whole of the spring. The three insulated plants exhibited nothing particular until the autumn: then the rose-tree in whose soil the brand-bearing leaves had been mixed became profusely covered

with the Uredo, the other two still remaining free; but the succeeding season the whole three plants were branded with myriads of Uredines.

(479.) The above experiments, Fee observes, appear to prove that the seminules of the fungi are absorbed by the radical fibres; that those which are mixed with soil, and become applied to the roots before the opening of the buds, are more readily absorbed and developed than after the leaves and flowers have been formed; as, in the two last instances in his experiments, they did not appear until early in the following spring.

(480.) The period in which fungi burst is often the period of their maturation, so that the wind carries their spores in clouds from place to place, and the rain precipitates them to the ground, and washes them into the soil. The viscidity of these spores, when wetted, serves to fix them to the root-fibres of the plants they subsequently grow upon, and of which they are sometimes supposed to be diseased formations, or equivocal descendants.

(481.) NEMASPORACEÆ. *Nemaspora*, the thread-brand, (from *νημα* and *σπορα*,) and *Stilbospora*, the brand-sheen, (from *στιλβος* and *σπορα*,) are the normal genera of two small groups, called by Fries *Nemasporei* and *Stilbosporei*, (*Nemasporidæ* and *Stilbosporidæ* of the present scheme of nomenclature.) These, together, form the type *Nemasporaceæ*, which is easily distinguished from the preceding by the presence of a spurious stroma, to which the sporidia are attached. It is likewise well distinguished, both from the preceding and succeeding types, by all the genera it contains being found on dead, while the former are wholly, and the latter chiefly, parasitic on living plants.

(482.) SPORODESMIACEÆ. *Sporodesmium*, the bond-blight, (from *σπορα* and *δεςμὸς*,) gives name to a small type, containing a few genera of not very important parasitic fungi, which are distinguished from the foregoing by the presence of a genuine receptacle, or stroma, to which the flocciform sporidia are attached. They are found on various plants, both living and dead; and hence would seem to form a connecting link between the two preceding types.

(483.) These three types, the *Uredinaceæ*, the *Nemasporaceæ*, and the *Sporodesmiaceæ*, collectively, form the section *Uredinæ*, the first, or lowest, in the order *Uredinales*, or *Mucedinales*. By Fries they have been called *Fungi entophyti;* and the chief diagnostic signs will be found to be, that the sporidia are either wholly

uncovered, and seated on the surface of the leaves of the plants on which they grow, or that they quickly become so by bursting through the cuticle by which at first they were covered and concealed. Hence, from this one portion of the group, the common name *Entophytes* was derived; which, however, although rightly descriptive of a part, is not truly applicable to the whole.

MUCEDINÆ.

(484.) Much difference of opinion has existed, and does still exist, amongst mycologists, as to the proper and systematic location of the genera included in this and the following section. To those who seek constantly for absolute divisions between the several groups of fungi, they will doubtless long remain stumbling-blocks; but to those who study the connexions of plants as essential means towards their natural distribution, these osculant tribes are always welcome links; although they are constant memorials of the imperfection of language, which does not allow us to express in definitions all the differences which our senses enable us to perceive.

(485.) Fusidiaceæ. In the first type of this section, the flocci, of which the receptacle is formed, are uniform, although varying in texture, some being rigid and persistent, others loose and evanescent; and upon these and other slight variations, further subdivisions have been attempted to be founded; but as the genera now known are few, and none of them of very commanding interest, the subordinate groups seem scarcely to be required, and therefore, as tending to complicate the study, they are not admitted here.

(486.) The *Fusidia* are found on the dead or dying leaves of the oak, beech, &c., and the other allied genera on other plants, as the Trifolia, while some luxuriate on rotten wood, dung, and similar matters.

(487.) Botrytiaceæ. *Botrytis*, the grapelet-mould, with its allies, *Penicillium* and *Aspergillus*, form the second type, which is known by the flocci being, for the most part, of two different forms and septate.

Aspergillus, lately separated from the old genus *Monilia* [§ 414], although connecting the *Byssaceæ* with the *Mucedinæ*, appears systematically rather to belong to this group than to the one in which Monilia is now arranged. Its history has, however, been already given when treating of Monilia, the genus in which it was formerly included.

(488.) The two types, *Botrytiaceæ* and *Fusidiaceæ*, when united, form the section *Mucedinæ;* the chief collective and distinctive characters of which group are derived from the sporidia being scattered over the flocci of the receptacle, and, although at first covered, quickly becoming free.

MUCORINÆ.

(489.) The MUCORINÆ have often, from an anatomical error, been arranged in the succeeding order, the TUBERALES or *Gasteromycetes*; but Fries has acutely distinguished between the inflated joint which, in the *Mucorinæ*, contains the *sporidia*, and the dense tunic formed by the interweaving of the flocci which forms the investment in the Tuberales: the latter having long been named *Peridium*, [§ 536-7:] the former, which bears some slight resemblance to it, is called the *Peridiolum*, [fig. *c*, *d*, *e*.]

Ascophora Mucedo.

(*a*) Natural size.

(*b*) Different stages of growth.

(*c*, *d*) Mature.

(*e*) Head, or peridiolum, artificially ruptured.

(*f*) ———————— collapsed.

(*g*) Sporidia.

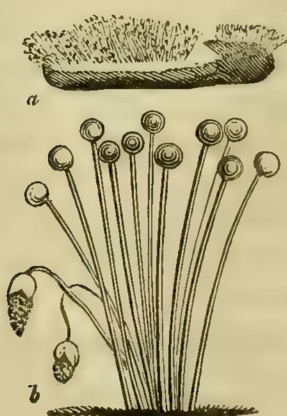
(*h*) Sporidiola, or spores.

(490.) ACREMONIACEÆ. *Acremonium*, the branching-mould, from *ακρεμων*, a branch, (the sporidia in this plant spring from the filaments as branches do from trees,) forms, with its allies, *Verticillium*, *Stachylidium*, and others, a small type called the *Acremoniaceæ.* The histories of these plants have not hitherto been sufficiently investigated to allow any facts to be recorded of them of special or peculiar interest. Their functions appear to be chiefly those which

are common to the whole order, and hence a short definition is all that will be required here. The chief distinctive characters of the type, as given by Fries, are "*Peridiola resembling sporidia, and affixed to the flocci* of the thallus, to the filaments of which, in some, the peridiola are adnate."

(491.) *Bactridium* and *Syzygites* have been separated from the other Acremoniaceæ by Fries, on account of their peridiola being tumid and adnate; if they are to be distinguished, it appears to be sufficient to form them into a subtype. However, even this seems to be scarcely wanting.

(492.) Mucoraceæ. *Mucor*, mildew, and *Eurotium*, mouldiness, both terms derived from Greek and Latin words, (ευρως and μυκης, or Mucor,) equivalent in their signification to the common English names of which they are synonymes, form, with their allies, *Ascophora, Thamnidium,* &c. the type *Mucoraceæ.*



Mucor caninus.

(*a*) Natural size.

(*b*) Magnified; the peridiola bursting, and discharging sporules.

These plants are very common on putrefying substances of various kinds, such as bread, meat, cheese, and fruit. The natural history of a part of these plants has been sedulously investigated; but a still larger portion seems to need much further research, and the special habitats and stations of the several genera and species require to be ascertained: for, from various accidents that have happened, and certain observations which have been made, it would seem probable that some of these parasitic fungi may afford indexes to the wholesome and deleterious states of many articles of food; in the same way as the lichens have been shewn to characterize various officinal barks, and to indicate their sound and worthless conditions.

(493.) Cases have frequently occurred, both in this country and

abroad, but they appear to have excited more attention in Paris than elsewhere, in which persons, after having eaten bread, meat, and other ordinary viands, have been seized with vomiting, purging, violent colicky pains, and other symptoms of having taken poison. Occasionally, suspicions of having administered poison have rested on those who had the charge, or had been engaged in the preparation of the food; but, on subjecting the suspected matters to chemical analysis, no trace of any deleterious substance has been found, *i. e.* no trace of any of the substances ordinarily considered poisons.

(494.) It has, however, long been known that animal and vegetable substances, which form, when sound, perfectly wholesome food, become, in certain stages of decomposition, highly deleterious; such especially is the case with corn, with wheaten and other flour, with meat, particularly pork, and many other articles in common use as food. Furthermore, the injurious qualities do not frequently hold a direct ratio with the degree of decomposition; but, even in the early stages of change, as in that of the human body, the hurtful principle is elaborated, and subsequently disappears; while, again, it sometimes happens that, at a later period, decaying organic bodies give out gases which are some of the most septic poisons the chemist knows of.

(495.) M. Chevallier, of Paris, has paid lately considerable attention to this subject, and has published several interesting memoirs relating to it. He expresses his conviction that cases of poisoning from this source are much more frequent than is generally supposed, and that they escape attention chiefly from the ignorance of the persons who mostly suffer. M. Chevallier, it appears, has noticed the deleterious change more frequently in pork than in other kinds of food, a very large quantity of which meat is consumed in Paris. He computes the annual consumption in that city alone at upwards of eight million pounds.

(496.) Numerous cases in point are recorded by M. Chevallier. Several occurred simultaneously in the family of a physician, whose wife, daughter, and servant were the sufferers. Another case happened in the practice of M. Brichetlau, who was sent for to attend a woman about forty years of age. She had been vomiting for several hours; her abdomen was excessively tender and her bowels much disordered; for, besides suffering extreme agony, she had, during the night, upwards of fifty evacuations. This malady was

traced to her having eaten some slices of bacon, purchased from a pork-butcher in the neighbourhood, for a young woman, who had taken a small morsel of the same meat, was similarly affected; and, on further inquiry, it was ascertained that a third person had been very ill who had eaten some pork purchased at the same time and place.

(497.) Several similar accidents having happened, official inquiries were instituted; and Drs. Durocher and Gœury, who were associated with M. Chevallier, reported that, although carefully analysed, no poisonous substances, such as arsenic, copper, &c., could be detected. But "the meat, a portion of which had occasioned the illness of a woman, was composed of several pieces cut from a lump of a preparation called *Italian cheese*, which is made of fragments of pork, &c., strongly seasoned, and converted into a kind of compact pie, that is usually sold in slices. The pieces examined were covered, some with blue and others with green mould; the latter giving the mass something of a coppery appearance:" and the report concludes by stating the conjoint opinion of all three, that the disorder was occasioned by the meat itself having undergone a partial decomposition. Dr. Paulus, of Saltz, has also placed on record seven cases of persons who were thus poisoned by eating Italian cheese, of whom three died; and various instances are known in which similar effects have followed the eating of ham pie, and other food, in which analogous alterations had taken place, and which seem to have been indicated by the fungi present.

(498.) Similar conclusions were arrived at by MM. Labarraque, Lecanu, and others, who have been engaged in similar inquiries; in one of these a pie had, in like manner, caused the serious illness of eight persons.

(499.) Bread made from flour undergoing decomposition has likewise been ascertained to be equally injurious. A case in point occurred about two years since at Hammersmith, in the family of the beadle of that hamlet. It is shortly as follows: The wife of the beadle bought in the morning a loaf, of which she ate a slice for her breakfast, and her son, twenty years of age, ate two slices toasted. Almost immediately after the meal both became unwell, with symptoms similar, but less severe, than those already in the other cases described. The loaf, when examined, was of a yellowish colour, and, although baked the same morning, it was sprinkled

with minute fungi, the greater part of which was black, or of a very dark colour; a few were green, and several yellow. The bread was soft, inelastic, and so tough that it could be drawn into strings; its taste and smell both were unpleasant.

Chemical analysis in this, as in the former cases, only afforded negative results. No recognisable poison, whether mineral or vegetable, could be traced; indeed, the absence of all known poisons was ascertained.

(500.) Some of the bread which had so much disordered both the woman and her son was then given to a dog, and some more to a cat, who were both similarly affected; and the evidence of the unwholesome state of the bread was thus rendered complete.

(501.) But a question arose as to whether the poisonous quality should be attributed to the bread, or to the fungi growing upon it. Further experiments proved that it was owing to some change in the bread, and not to the fungi, which are themselves innoxious; for a considerable quantity of the fungi, about five grains, having been collected, they were swallowed by a person, aged twenty-two, without any bad result; while a small bit of the bread, from which the fungi had been scraped, gave rise, when eaten, to colicky pains and tendency to diarrhœa.

Further evidence to the same effect was soon afterwards obtained. A quantity of dough was allowed to become mouldy in a damp place, and, when the mould was carefully removed, the dough was made into a small loaf, and baked. The loaf thus formed had precisely the same physical and poisonous properties as the Hammersmith bread, while the mould was eaten by a cat, a dog, and the experimentalist, with perfect impunity. On analysis, the bread was found to contain much less gluten than usual; the other proximate principles were in their ordinary proportions. [*Journ. de Chimie Médicale*, Dec. 1832, and *Lancet*, Feb. 1833.]

(502.) It is to be regretted that no botanical description has been given, in any of these cases, of the fungi growing on the deleterious food; and which not improbably will prove to be indices of the poisonous qualities of the substances on which they are found. It appears, from the slight notices of them, that they belong to the section now under consideration, and mostly to the present type, several genera of which are known to luxuriate on decomposing organic matters of various kinds.

(503.) The genera included in the type Mucoraceæ all agree in

having [§ 452,] "a distinct inflated peridiolum, growing from septate tubulose flocci; the sporidia also are distinct," [*Fries.*] These therefore become the distinctive and collective characters of the type.

(504.) STILBIACEÆ. *Stilbum*, the glaze-dew, (from στιλβος, shining,) is the normal genus of a very small and unimportant type, named, from it, the *Stilbiaceæ*.* These plants are distinguished by having "a thin and fugacious peridiolum, which is capituliform, confounded with the sporidia, and placed upon a continuous turgid stipes (stalk.)"

(505.) The three types *Stilbiaceæ*, *Mucoraceæ*, and *Acremoniaceæ*, form, collectively, the section *Mucorinæ*. The sporidia being free, and bursting through a simple, free, everted peridiolum, are the points in which these types agree, and, consequently, form the characters by which they are associated.

TUBERCULARINÆ.

(506.) TUBERCULARIACEÆ. *Tubercularia*, the wart-mould, and *Fusarium*, the spindle-mould, form a small type, called, from the first or normal genus, the *Tuberculariaceæ*. In these plants "the receptacle is either roundish or flattened, at first innate, but afterwards free, being covered with the subdiffluent sporidia," (*Fries.*) The Tubercularlæ are common all the year on rotting sticks and the dead branches of trees; but they are much the most abundant in the autumn, when the T. confluens and granulata are added to the T. vulgaris. They spread over brush and fire-wood, and decaying sticks, in such profusion as to give them the appearance of having been sprinkled with red varnish, or thickly studded with small red beads.

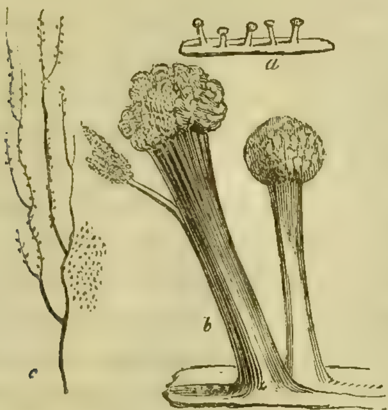
(507.) DERMOSPORIACEÆ. *Dermosporium*, and its allies, though closely connected with the former group, differ from the Tuberculariaceæ in having "a smooth, nearly spherical receptacle, seated superficially, freely evolved, and covered by the incumbent sporidia." None of these are plants of particular interest. The normal genus, of course, gives its name to the type.

(508.) CERATIACEÆ.† *Ceratium*, the horn-mould, with some few other genera, in which the receptacles, of various figures, are constructed of interwoven flocci, form the *Ceratiaceæ*, the third and

* Stilbini of Fries.

† Scoriadei and Cephalotrichei of Fries.

last type in this section. Certain genera, such as *Ceratium* and *Scorias*, have the receptacle more or less horizontally expanded, and they form the subtype *Scoriadæ;* while in the other remaining genera, such as *Cephalotrichum, Isaria*, &c., the receptacle is extended vertically and is club-shaped, either capitate, or branched. These form the subtype *Cephalotrichidæ;* of which Floccaria is a beautiful example.



Floccaria glauca. *Grev.*

(*a*) Group of plants, natural size, on a solution of gum arabic.

(*b*) Two plants, magnified, shewing the vertical clubshaped receptacle bearing sporidia on the flocci.

(*c*) Sporidia and filaments still further magnified.

(509.) The three types *Ceratiaceæ, Dermosporiaceæ*, and *Tuberculariaceæ*, associate to form the section *Tuberculariniæ*; the chief collective and distinctive characters of which will be found to be the following. "Sporidia simple, attached to a solid persistent receptacle, either superficial, or liberated during growth."

(510.) Not any of the plants included in this section have the commanding interest of some of those described in the former, especially among the Uredinæ; still they all perform sedulously their parts in the general economy of nature, and labour, with their numerous associates, to disintegrate and dissolve the various dead and decaying organic bodies, some of which appear to be almost exclusively consigned to each. Probably, when their histories are more studied, and better known, the naturalist will find more abundant materials to enrich his records of these humble yet useful denizens, some of which are just on the confines of the vegetable world.

(511.) The sections *Urediniæ, Mucediniæ, Mucoriniæ*, and *Tuberculariniæ*, form, when associated, the order already named [§ 442,] Mucedinales. The naked sporidia, either always destitute of covering, or quickly becoming denuded, with the destitution of true peridium, perithecium, and hymenium, organs present in the other

orders, form the characters which associate these sections into a common group or order, and distinguish them from all other fungi.

(512.) The gradual development of special organs in the several grades of the lower fungi is inversely analogous to those evolutions of structure already traced in the lower Algæ. For, as in the flags, the thallus at first appeared, and was destitute of spores, so, on the contrary, in the fungi, the sporidia, in the most rudimentary stage, exist without a thallus. In Cylindrosporium they are even destitute of any covering, and in the Uredines an adventitious tunic alone is gained by the Entophytes elevating the cuticle of the plants on which they grow, and through which they burst. Subsequently, in Stilbospora, a spurious, and in Sporodermium, a true thallus (Stroma,) or receptacle, is formed, which in the Næmasporaceæ was in a very rudimentary state. In the Mucedinæ the receptacle becomes floccose, and, in the early stages of growth, the flocci cover the sporidia with which they are interspersed; and, in the Mucorinæ, the terminal cellules of the filaments become dilated, forming peridiola which contain the sporidia within them. These ventricose cells prefigure the peridia of the succeeding order; and the firm solid stroma which occurs in the Tubercularinæ may in like manner be esteemed an anticipation of the hardened nucleus found in that group of the Tuberales which some botanists hence have named the *Pyrenomycetes.*

The following tabular conspectus will serve as an index to the several types and sections contained in the order Mucedinales. The figures refer to the definitions of the several groups.

MUCEDINALES (511)	Tubercularinæ (509)	*Ceratiaceæ* (508)
		Dermosporiaceæ (507)
		Tuberculariaceæ (506)
	Mucorinæ (505)	*Stilbiaceæ* (504)
		Mucoraceæ (503)
		Acremoniaceæ (490)
	Mucedinæ (488)	*Botrytiaceæ* (487),
		Fusidiaceæ (485)
	Uredinæ (483)	*Sporodesmiaceæ* (482)
		Nemasporaceæ (481)
		Uredinaceæ (458)

TUBERALES.

(513.) The organs foreshadowed by the hardened receptacle, the fruit-bearing cellules, the interwoven flocci, and the false or adventitious tunics of the preceding groups, become fully developed in the several sections of the present order, and are distinguished by the names of *nucleus* and *asci*, *sporangia* and *perithecia*. Not that each organ is equally perfected in every group; for, in one, the nucleus, in another the floccose sporangia, and in another the asci, are predominantly evolved; and even the tunic, which is present in all, is sometimes double, and sometimes single; in some types free, in others connate, and in the lowest group of all so obscure as to be often considered obsolete.

(514.) The constant presence of the involving pouch, by which all the other organs are enclosed, renders it a most important associating character and diagnostic sign of the Tuberales; and, from its general ventricose form, these tuberiform fungi have sometimes been collectively called the *Gasteromycetes*. This name has, however, been used with such different significations, and employed to designate groups of such varied extent, that it has lost much of the precision which forms the chief value of a technical term. Thus by some it is given indifferently to all the ventricose fungi; while by others it is restrained to those only which have pouches without internal nuclei; and the nucleiferous Tuberales have been occasionally called *Pyrenomycetes*. But the distinctions here hinted at, as founded on the presence and absence of nuclei, although far from insignificant, when used as subordinate diagnoses, do not appear to be of such paramount importance, or universal application, as to compel a naturally allied order to be severed in two. Hence here the whole are included under the term *Tuberales*, a name derived from *Tuber*, the truffle, one of the most important and best known genera in the group.

SPHÆRINÆ.

(515.) Certain fungoid excrescences common on the leaves and other parts of plants, and named by Fungologists *Asteroma*, *Ectostroma*, &c., are many of them decidedly not distinct vegetables, but morbid growths: and others, although fungi, are fungi

the development of which has been arrested, and the sporidia not evolved. These essential organs being abortive, they are not admitted among the normal genera of the group, but form an appendix to the type *Xylomaceæ*, the first and lowest of the section *Sphærinæ*. Even in Xyloma, the typical genus, the sporidia are so obscure, that their presence has been sometimes doubted.

(516.) The *Asteromata* are minute barren fibrillæ, scattered over the deciduous parts of plants; the *Depazeæ* are minute dots on leaves; and the *Ectostromata* irregular spots, without any traces of fructification or regular organic structure.

(517.) *Xylomaceæ*. In *Xyloma*, the most rudimentary genus of this type and section, the pouch and nucleus are obsolete, so that it is chiefly distinguished by the negative character of the sporidia being *not* external and exposed, as in the preceding order. In the allied genera, *Leptostroma* (or thin scale-mould), *Actinothyrium* (or ray-pouch), *Lasiobotrys* (or wool-bunch), the nucleus and pouch (perithecium) become more and more distinct; but the sporidia, which are inclosed within the perithecium, are not collected in asci, but are free, resembling those attached to the flocci of the *Mucedinæ*. The nucleus, to which the sporidia are fixed in the above genera and their allies, is dry; and the perithecium ruptures irregularly: hence they have been associated to form the subtype *Xylomidæ*, which is thus distinguished from its co-ordinate *Cytisporidæ*; for, in the associated genera of this second subtype, the perithecium opens by a regular mouth (ostiolum), and the nucleus is soft and deliquescent. These two subtypes, each of which contains but very few genera, are allied by their sporidia being free, the cells in which those organs are contained in the subsequent types being obsolete, or very fugacious.

(518.) *Xyloma* is a fungus of such common occurrence, and in some of its species spreads so profusely, that it can hardly have escaped the notice even of the least observant. It is found on the Willow, Poplar, Beech, and many other plants, especially the Sycamore and Maple, the leaves of which are often so thickly covered by its broad black spots as entirely to change the aspect of the trees; giving them a mournful appearance, which sometimes but ill accords with the season, and with their associates of the forest or the fields.

(519.) *Cytispora* (the coffer-mould), with its allies, *Septoria*, *Sphæronema*, and others, which, together, form the subtype *Cytis-*

poridæ, are chiefly interesting as illustrations of progressive development; for, although the *asci* are not yet formed, they are anticipated by a thin fugacious cellule, in which the sporidia are, in the early stages, enclosed.

(520.) PHACIDIACEÆ. *Hysterium*, *Cliostomum*, *Dermea*, and *Patellaria*, are four genera which, with their respective allies, form four subtypes, called the *Hysteridæ*, *Cliostomidæ*, *Dermidæ*, and *Patellaridæ*. Associated, they constitute the type PHACIDIACEÆ, the second that occurs in the section Sphærinæ.

(521.) *Hysterium*, the penury-mould, so called from the wretched and miserable appearance of the plants on which this fungus abounds; *Phacidium*, the lentil-mould, and *Phytisma*, the wrinkle-mould, are the most important genera contained in the first subtype, the *Hysteridæ*, (Phacidei of Fries,) and consisting, especially the first, of the largest number of species. These plants are "subinnate, their perithecia subdimidiate, and, when they open, they expose a naked nucleus."

(522.) *Cliostomum*, and *Lophium*, with one or two other genera which Fries has distinguished as a subordinate group, the *Cliostomidæ* (or Cliostomei), differ from the foregoing by having their perithecia entire, adnate, and dehiscing by very straitened chinks. These fungi are likewise superficial.

(523.) *Dermea* and *Cenangium*, with the subgenera which the last-named genus includes, form the third subtype, *Cenangidæ*. These fungi are morphologically interesting, from the nuclei which bear the asci being in the shape of disks, somewhat resembling the *hymenia* of a higher order, and from having the disks supported by more or less distinct floccose strata, connate with the coriaceous perithecium; which strata may be compared to the receptacle of the Mycetales. The above characters, which associate the genera, will also serve sufficiently to distinguish the subtype.

(524.) *Patellaria*, and its allies, *Stegia* and *Tympanis*, form in like manner the last subtype. The perithecia in these plants are open and margined, but the opening is covered by a fine veil or operculum.

(525.) In all the preceding subtypes, which vary in slight subordinate particulars, it is found that the perithecia are dehiscent, and the discöid asci are erect and fixed. These therefore become

the characters which associate them into a common type, and distinguish the contingent groups.

(526.) *Sphæriaceæ.* This type, like both the preceding, has been distributed by Fries into several subordinate groups; and, although the analysis is thus carried often almost to the verge of excess, it is difficult to avoid submission to such distinguished authority.

(527.) The genera *Dothidea*, *Strigula*, *Dichæna*, and *Sphæria*, are illustrations of those subtypes to which they give their respective names.

(528.) The *Dothidæ* are innate epiphytes, with the ostiola, when present, minute and like a pore.

(529.) The *Strigulidæ*, which have hitherto been noticed only on the leaves of tropical plants, have the ostiola unequal, often large, the stromata double; and subsequently becoming a horny crust.

(530.) The *Dichænidæ* have ostiola not prominent, but perithecia dehiscing by chinks. The stromata are discrete and adnate. These fungi grow both on dead and living plants.

(531.) The *Sphæridæ* have their ostiola regular, more or less predominant, generally round, rarely compressed. These fungi grow on various dead or scarcely living organic substances. Sphæria is a very extensive, and doubtless, an important genus, as assisting in the destruction and removal of dead and offensive organic matters. The annals of these plants are, however, scanty, and the records few, of their immediate utility to man. The indirect services they perform are evident to all.

(532.) The three types, *Xylomaceæ*, *Phacidiaceæ*, and *Sphæriaceæ*, which differ from each other by having their ascigerous nuclei moist or dry, and, when the asci are obliterated, the sporidia being fixed to the nuclei, agree in having their perithecia (which are cases enclosing the fruit-bearing nuclei), either perforated by ostiola, or irregularly dehiscent. The structure of these plants is obscurely cellular, and the stromata subfilamentous. Collectively, these types form the section *Sphærinæ*, of which the preceding characters are distinctive signs. In this section are included all those fungi which botanists, who use the term, call Pyrenomycetes.

(533.) In recording the names of such numerous genera, types and sections, including multitudes of species of these lower fungi,

a kind of disappointment is felt, that, of so many tribes, our ignorance allows so little to be said; that, while their structures have been examined, and myriads of species, which were once confounded and confusedly crowded into a single order, are now shewn to constitute an extensive class, distributable into groups, as distinct and as numerous, as the acknowledged orders of larger and less retiring plants; that so little should have been discovered of the final causes of their variety, as well as of their abundance; that vegetables of such exquisite formation, and of such astonishing variety, should not have each a tale to tell, of interest equal to their beauty. We feel dissatisfied that our notices should so often be confined to the bare statement that *they are*, and that all we know of their utilities is their general uses; duties which are performed by all the class in common, which, however, may be far more important than the particular purposes to which certain specific individuals are applied.

Doubtless, our ignorance veils much that is curious, very much that is important in the histories of these plants, which will hereafter be revealed; still, though little has been learned, enough even now is known, for us to join in the elegant apostrophe of Linnæus to the greatness of such minute wonders of creation. "Legi aliquot Dei vestigia per creata rerum, in quibus omnibus, etiam in minimis, ut fere nullis, quæ vis! quanta sapienta! quam inextricabilis perfectio!"

BOVISTINÆ.

(534.) The genera included in this section are very numerous, but the species contained in each genus few. This circumstance may, perhaps, be accounted for by the little tendency that these plants have to vary from their regular forms; which varieties, when they become permanent, it is often difficult to distinguish from original species; and hence they are specifically named and classed as such in all systematic works. But, though little subject to vary from their normal structure, there are none that exhibit more marked transitional developments, which, as Fries observes, may be compared to the noted metamorphoses of insects: the *Physaridæ*, and *Trichiadæ*, especially afford extraordinary instances of these regular transitions; indeed, one species of *Trichia* has hence been called the *many-shaped (polymorpha)*; a plant well known, at least

by name, from its having been discovered by the late Mr. Sowerby, in a very unlooked-for situation; *i. e.* in a place that is not often included in a botanical excursion, viz. at the top of the cathedral of St. Paul.

(535.) Many of the fungi contained in this class are meteoric, and, like other meteoric plants, they occur most abundantly during one season, in places where scarcely a single plant can be found in others. In their early stages of growth most of them are soft, and often slimy; but afterwards the majority become dry, like tinder or touchwood. The bulk of each fungus is formed of interwoven tufts of filaments (flocci,) interspersed with numerous sporidia, but not contained in *usci*, as in the previous section; from which the Bovistinæ (or Gasteromycetes) are further distinguished by the absence of a nucleus, an essential characteristic of the Sphærinæ (or Pyrenomycetes.) The mass of flocci is collectively called a *sporangium*; and the tunic which invests it a *peridium*. The peridium differs from the perithecium only in the adventitious circumstance of its covering a *sporangium*, and not including a nucleus. When a fungus, as is the case in the Truffle [§ 595,] appears to be compound, and to contain many smaller ones within it, the whole is called a *sporangium*, and the lesser portions *sporangiola;* their including membranes, analogous to the tumid cells of the Mucorinæ, are, like them, denominated *peridiola.*

(536.) In size the Bovistinæ vary more than do the species contained in any other section. Indeed, they nearly approach the extremes of bulk hitherto observed, the *Erysiphidæ* being among the smallest, and the *Bovistinæ* (for example, the huge Bovista gigantea,) amongst the largest fungi known. In form likewise they are not less remarkable, for the Phalli and Clathri are some of the most extraordinary vegetables in existence.

(537.) Sclerotiaceæ. *Erysiphe*, the round-mould, *Sclerotium*, the hard-mould, and *Rhizoctonia*, the death-mould, are the normal genera of the three subtypes, *Erysiphidæ*, *Sclerotidæ*, and *Rhizoctonidæ*, included in the type Sclerotiaceæ.

(538.) *Erysiphidæ*. *Erysiphe*, or *Erysibe*, is an old Greek name for mildew, and many of the species of the modern genus are popularly known as moulds, or mildews: they infest especially living vegetables, and are commonly found upon the leaves of the pea, clover, berbery, and many other plants, either scattered over

the surface like powder, or collected into spots and patches. The names of the different species are, in general, derived from the different vegetables on which they grow.

A. Erysiphe adunca.

(*a*) Numerous plants on a willow leaf.
(*b*) One plant detached.
(*c*) Peridium bursting from excess of moisture.
(*d*) Sporangiola.
(*e*) Filament magnified.

B. Erysiphe Pisi.

(*f*) Groups of plants on a pea-leaf, natural size.
(*g*, *g*, *h*) Plants detached, and more or less magnified; one sporangium bursting.
(*i*) Sporangiola inclosing the sporidia.

In *Erysiphe*, and its associates, *Perisporium*, *Lasiobotrys*, &c., which compose the subtype *Erysiphidæ*, the peridia, which are confused and blended with the sporangia, include sporangiola. They are also epiphytic on living plants.

(539.) *Sclerotidæ*. *Sclerotium*, and its allies, *Periola*, *Acrospermum*, and *Sphacelia*, or *Acinula*, differ from the *Erysiphidæ*, by having the peridia, which, as in them, is confused and almost obliterated, always closed. Internally it is obscurely vesicular and sporidiferous; the spores at length emerging, but not by any regular dehiscence. Some of these are most destructive fungi, being parasitic not only on dead, but on living vegetables, which will distinguish them from some of the following group, part of which are superficially attached to dead vegetable matter, while the rest are parasitic on plants that are alive. The *Periolæ* infest the roots of potatoes, and other plants; and the *Acrosperma* are found on putrid fungi of larger kinds, as well as on dead herbaceous plants.

(540.) *Acinula*, or *Sphacelia*, is, however, the most important genus in the group. It used to be considered a species of *Sclerotium*, but it is easily distinguished by its diffluent peridium being spread over a berry-like, club-shaped sporangium; whence its name, *Acinula Clavus*. The synonyme *Sphacelia Segetum* has reference to the gangrenous diseases with which animals become affected who are fed on spurred grain, as corn is called when bearing this fungus.

Secale Cornutum.

D. A healthy ear of rye.

(*a*, *b*) Culm and spike.

E. Figure of a similar ear of spurred rye.

(*a*) Culm.

(*b*, *c*) Ear with natural spikelets, and also with others affected with the ergot.

(*d*) A spikelet, separated to shew the fungus on the ovary or young grain.

(*e*) The awns.

(*f*) The husks.

(*h*, *g*) Two entire and full-grown samples.

(*i*) The ovary magnified with the spur in an early stage.

(*k*) A section to shew the sporidia.

(*l*) The sporules.

(541.) By some persons the ergot, or spur, is considered to be a *disease* of the grain, occurring spontaneously; others think that it is an unnatural condition, produced by the puncture of insects. Both these opinions have been attempted to be supported by direct experiment. Willdenow states that he could produce the ergot at pleasure in rye, by excessive watering; while General Martin Field, who had observed flies puncture the ears of rye during their milky state, imitated the process by wounding them with a needle. In both cases he found the juice exude, and in four days a small black point was visible, which he affirms subsequently became a spur. Fontana, on the contrary, states that the ergot may be propagated from plant to plant, and even that he has expressly transmitted it by contact from ear to ear. Hertwig, however, in repeating Fontana's experiments, arrived at a different result. But this matter is now set at rest; for De Candolle, and others, have

determined the ergot to be a distinct parasitic plant, which locates itself in the ovary of many of the grasses. The seeds and seed-vessels affected, instead of becoming normally developed, are perverted in an early stage of their growth, and a lengthened club-shaped body protrudes from the husks in place of the grain. From this peculiarity of form it has received the specific name *clavus*. Hence also may be traced the origin of its more common appellations *ergot* and *horned*, or *spurred* grain, from its resemblance to horns, or cockspurs.

(542.) Rye is more frequently and commonly attacked by this fungus than any other grass: hence the *ergot of Rye*, the *horned* or *spurred Rye*, the *siegle ergoté*, or *secale cornutum*, of medicine, will form the most familiar example. But, although the most common, rye is not the only habitat; for the ergot has been found on wheat, oats, maize, and barley, among the *Cerealia;* and upon many of the fodder-grasses, as, for example, *Alopecurus pratensis*, *Lolium perenne*, *Holcus avenaceus* and *lanatus*, *Aira cristata*, *Agrostis stolonifera*, &c.

(543.) The presence of this fungus alters in a most important manner the qualities and properties of the grain on which it is found; not only, like the uredo, diminishing the proportion of nutritive matter, but converting a wholesome grain into a hurtful food, and even a fearful poison. Like many other poisons, however, the ergot forms, when duly administered, a valuable medicine; being peculiarly serviceable in one of the most interesting and hazardous conditions to which women are subject: for, without exaggerating its virtues, it may be fairly said that the discovery of this little fungus has added a new article to our scanty list of heroic, or specific remedies.

(544.) Corn is much less subject to be affected with ergot in this country than in France; and, as we grow much less *rye* than many of our continental neighbours, the *Secale cornutum* has been occasionally scarce, which has led to a variety of frauds. Some specimens, which were procured for analysis by a celebrated chemist, were found to be only plaster of Paris casts coloured in imitation of the ergot. No wonder, when such fictitious samples are in the market, that great discrepancies should occur in reports of the specific powers of this extraordinary substance, which, even in its natural state, is liable to be rendered more or less potent by the influence of external physical causes. For example: as it has

been ascertained that, in the bitter almond, the prussic acid is chiefly, if not wholly, confined to the testa of the seed, so, in the ergot, the active principle resides in the diffluent peridium, [§ 540]; hence if heavy rains fall at the time the peridium is soft and moist, it will be washed away, and the hardened club-like nucleus, if wholly denuded, will be utterly inert. But, if the weather be fine during the maturation of the fungus, the diffluent peridium will be dried upon the spur, and the ergot be in its most active state. Hence, for medicinal purposes, and also when spurred grain is to be used as food, especial regard should be had to the above circumstances.

(545.) The disease referred to, as following the long-continued use of spurred rye for food, is that most extraordinary affection, the *dry gangrene;* which becomes, occasionally, an endemic, and even an epidemic scourge.

M. Dodard first called the attention of the public to this disease, in the year 1676. He says "it had been long known that persons who ate rye bread made with corrupted grain were liable to be affected with gangrene in their extremities, attended usually with little fever, inflammation, or pain; but, during the progress of which, the use of the limbs affected was lost, or the limb itself died, and separated from the body. The parts at first became insensible and cold; and, in the progress of the disorder, dry, hard, and withered. In very malignant cases, Dodard says that delirium occurred; and he also mentions, that the grain proved fatal to fowls that fed upon it."

(546.) Saviard relates various cases which he witnessed in 1694, and for which he was obliged to perform some original operations. He says "that the disease is very frequent in Sologne; that it attacks those who eat rye affected with the cockspur; and that the upper and lower extremities of the patients he saw grew, during the course of the disorder, as dry as touchwood, and as emaciated as those of Egyptian mummies."

According to the severity of the attack, greater or less portions of the limbs are destroyed; of thirty patients, seen by M. Noel in one season (1710) in the Hotel Dieu of Orleans, some lost only their toes, others their feet at the ankle-joints, others the whole of their legs; and, in one case, communicated to the Academy of Medicine, the lower extremities separated from the trunk at the hip-joints; the heads of the thigh-bones disarticulating from the *Acetabula*. This lamentable occurrence is reported to have first suggested that important surgical operation, amputation at the hip-joint; for granulations formed, and the sufferer recovered, even after such a fearful dismemberment of the body.

During the thirty-three years that the M. Noel abovementioned was surgeon of the Hotel Dieu, at Orleans, this disease was endemic four times. Little relief save amputation could be afforded to the patients, for they seldom applied until the noxious grain had worked its worst. The symptoms in all appear to have been nearly the same, "the part affected becoming black like a piece of charcoal, and as dry as if it had been passed through the fire." The fatality of the complaints appears to have been very various, for sometimes the majority recovered with the loss of one or more limbs, while at others, as in the endemic of 1748,

M. Duhamel reports, that of 120 persons attacked, scarcely *four* or five escaped with their lives. Languis also states that it was equally fatal in Switzerland.

(547.) A calamity so serious, and recurring so often, could not fail to attract public attention, and stimulate the curiosity of medical men ; and, accordingly, we find that, in France, many attempts were made to discover the true source from which it proceeded. In attending to this subject, it was soon discovered that *animals of every kind, except man,* refused, in general, to eat rye affected with the cockspur; and that many of them would rather starve, than taste bread or food of any kind into which a portion of it had, for experiment, been introduced. Those animals which were found or forced to swallow it were observed to die of gangrene, which, in different individuals, attacked different parts of their bodies.

(548.) When the spurred grain bears only a small proportion to that which is sound, the blended corn may be eaten with impunity. Thus, in countries where the ergot prevails, the harvests of ordinary years, though seldom, if ever, wholly free, afford food which may be eaten without notable injury. But when a wet spring or summer occurs, by which the growth of the fungi is favored, and the grain becomes affected to the amount, as often happens, of one fourth or one third of the gross product, then it is that the endemic rages. Some persons seem to be peculiarly susceptible of its influence, and others impregnable to its baneful effects. This may be often owing to peculiarities of constitution; but the apparent paradox, that grain, in which the spur prevails in equal proportions, will in some years produce this loathsome disease, and in others be wholly inert, can be only explained by the observation of Seveillé, before alluded to, viz. that the active principle resides chiefly, if not entirely, in the diffluent peridium, which may be, and often is, washed off, if heavy rains fall during the ripening of the fungi; for, although moisture favors their early growth in spring and summer, it is a dry autumn which insures their activity.

(549.) This occasional impunity led some persons to doubt the deleterious properties of ergot. M. Tessier, however, clearly proved, that in those seasons only in which the spurred rye was very abundant, did the epidemic gangrene appear ; and he instituted experiments upon animals, which completely established its poisonous qualities. He also found, as others had before him, that animals have a strong aversion to spurred corn, either alone, or mixed with the substances on which they usually feed. Hence it became extremely difficult to disguise the diseased rye, so as to induce animals to swallow, voluntarily, any portion of food into which it had been introduced. He succeeded in administering it to two ducks, two pigs, and a turkey. They all perished after a certain length of time. The duck, drake, and turkey, in nine, fourteen, and twenty-two days respectively. In all, the extremities of the body suffered most, becoming pale, yellow, emaciated, and ultimately gangrenous. Dr. Robert further observes, that dogs and cats, in consequence of discharging the ergot by vomiting, suffer only slight symptoms of irritant poisoning; but that swine, moles, geese, ducks, fowls, quails, sparrows, as well as leeches and flies, are sooner or later killed by it; and that the symptoms it causes in beasts and birds, are, in the first instance, giddiness, dilated pupil, and palsy; and afterwards, diarrhœa, suppurating tumours, scattered gangrene throughout the body, and sometimes dropping off of the toes.

(550.) Sologne, where this malady most frequently occurs, is a district which

appears, from its physical conditions, to be most peculiarly fitted for the production of the ergot. It is situated between the rivers Loire and Cher; the soil is poor, chiefly clayey, or clay-bound, and very wet; so wet, that the corn is obliged to be sown on the *tops of furrows a foot high;* and so poor, that, although it is suffered to lie fallow every third season, it is exhausted at the end of ten or twelve years at farthest, and the farmers are compelled to let it remain a long while in the state of pasture, before it will again bear corn.

In this district it therefore was that the Abbé Tessier, who was deputed by the French Academy to examine more particularly the circumstances attending this disease, made his observations. Of these Dr. John Thompson has availed himself in the compilation of his valuable essay, the most important parts of which have been condensed and combined, with the researches of others, in this history of the plant now under consideration.

(551.) Rye is so little cultivated now in England, that, although the ergot does occasionally appear, when wet seasons and wet poor soils favor its development, still it never occurs in sufficient abundance to produce the calamitous effects recorded by the French physicians. But wheat, and other grain, is obnoxious to the same, or similar attacks; and it is not improbable that many of the epidemics of former times, and even of the present age, may originate from such a cause. A case immediately in point is recorded in the Philosophical Transactions for the year 1762. It is narrated by a Dr. Wollaston; but the previous history is given by the Rev. Mr. Bone, the curate of the parish. From these accounts, it appears that a farmer, in the village of Wallisham, about sixteen miles from Bury St. Edmund's, in Suffolk, had some of his wheat laid by bad weather, and, that it might not spoil his samples, he had it gathered and threshed separately. This diseased or damaged wheat was threshed at Christmas, and was sold at a low price to several of the labourers on the farm, and other poor persons in the village. One family, consisting of a man, his wife, and six children, eat no other bread than what was made from this wheat for a considerable time: they were accustomed to buy two bushels of this clog-wheat or rivets, or bearded wheat, (as it is variously called in the country,) every fortnight; and, although it made bad bread, and worse puddings, they still persisted in its use until they were all attacked with gangrenous ergotism. The mother and six children fell ill within a few days of each other. The earliest symptoms, which were intense pains in the lower extremities, were first felt on the 10th of January; these, however, subsided in a few days, and then succeeded the mortification.

The following was the state of this miserable family, at the time that Dr. Wollaston's report was drawn up and sent to the Royal Society:

"*Mary, the mother, aged forty.* Right foot off at the ankle; left leg mortified, a mere bone, but not off.

"*Elizabeth, aged thirteen.* Both legs off below the knees.

"*Sarah, aged ten.* One foot off at the ankle.

"*Robert, aged eight.* Both legs off below the knees.

"*Edward, aged four.* Both feet off at the ankles.

"*An infant, aged four months.* Dead.

"*The father* was not attacked till about a fortnight after his wife and children, and in a slighter degree. In him the pain was confined to two fingers of his right hand, which turned blackish, and withered. Another labouring man in the same

parish, who had eaten of this bread, suffered from numbness in both his hands, for above a month. They were constantly cold, and his finger-ends peeled; one thumb, he says, still remains without any sensation."

Some of this corn was made into bread, and eaten in the farmer's family, and also by various other persons; but, as none of them experienced any ill effects, it is to be presumed that the quantity eaten by them was much less, or in much less proportion to other more wholesome food.

(552.) The *dry gangrene*, above described, is called *gangrenous ergotism* by the French, who mention another form of the disease, which they name *convulsive ergotism*. So different, however, are the symptoms which characterize these two maladies, that I cannot but agree with Dr. Watson, in 'suspecting that their causes must be different too.' For, instead of the characteristic symptoms of gangrenous ergotism, viz. great discomfort or *malaise*, nausea, languor, fainting, vomiting, with a sense of tingling or formication preceding the coldness and numbness, of the toes and lower extremities, which subsequently wither, dry, become black as if burned, and, lastly, drop off at the joints; the convulsive ergotism is chiefly marked by giddiness, spasms, convulsions, and painful contractions of the limbs, no mention being made of gangrene; and the symptoms recorded agree with Cullen's definition of Raphania. "*Articulorum contractio spastica, cum agitatione convulsivâ, dolore violentissimo, periodico.*"

(553.) These two forms of disease are seldom intermixed with each other. Of twenty-nine epidemics, accounts of which were collected by Ozanam, nineteen were of the convulsive, and ten of the gangrenous kind. Other instances have however been mentioned, in which the two sets of symptoms have been mixed. Dr. Frank, for example, has given an account of a disease, occuring in Germany, which forms a link between the Raphania or convulsive ergotism, described by the Swedish, and the gangrenous ergotism of the French writers. Convulsions were the prominent symptoms in Dr. Frank's cases; but these were almost uniformly followed by an erythematic inflammation of the limbs, and sometimes gangrene of the fingers and toes.

Some writers of the present day have hence supposed that the use of the spurred corn in a certain dose or proportion, gives rise to the convulsive affection, and that the habitual consumption of a larger proportion, or even a more protracted use of a smaller, determines the supervention of gangrene; so that the symptoms, distinct as they are in the two cases from each other, mark different stages merely, or different degrees, of the same malady.

(554.) The *Raphania* has been clearly traced in Sweden to the admixture of the seeds of the *Raphanus, Raphanistrum*, with ordinary bread-corn. In the sixth volume of the Amœnitates Academicæ, there is a treatise on the subject, by Rothman, in which the disease was traced to the R. Raphanistrum by a curious but very satisfactory process of induction.

In the first place, the author traces the disease to the use of some corn; shewing, that children who live entirely on milk never have it.

Secondly, he proves, by a similar mode of exclusion, that it is owing to the use of barley, and not of rye.

Thirdly, that it proceeds from the use of such corn sown in the spring.

Fourthly, that there is no diseased appearance observable in the grain itself, but that two seeds are found mixed with it, in those places where the disease occurs,

and not in the other parts of the country. These are the seeds of the wild cabbage (Brassica campestris), and of the charlock (Raphanus Raphanistrum.)

He then argues that the former of these is not the cause of the complaint, for it is found mixed with the rye also; he shews likewise that the disease was most prevalent after wet seasons, in which the Raphanus had grown most abundantly and luxuriantly: and, furthermore, an experiment made on an animal confirmed his opinion.

(555.) Curious and conclusive as these reasonings and observations are, as far as they go, it is probable that the chain is not quite complete; for although the cause of Raphania has been traced to the Raphanus, in the same way as gangrenous ergotism to the rye, it is unlikely that it proceeds from the consumption of the charlock seeds in a healthy state. The state of the charlock seeds should have been examined; for, if it be not owing to a morbid condition of the seed, or to the presence of some parasite analogous to the ergot, it would be difficult to account for Raphania not appearing every year, as the Raphanus is constantly and abundantly blended with the corn, both in Sweden and in this country. In England, however, Raphania is unknown.

(556.) This belief has persuaded me to quote the preceding account of *Raphania;* not so much for the sake of expressing an opinion as to the real origin of the disease, as to record my conviction, which is supported by good authority, that other epidemic and endemic maladies might be traced to similar causes. As I have before said, the history of the fungi has been as yet far too little studied; of their habits and properties there is far too little known. However, from what has already been discovered, we know that they perform a most important part in the general economy of nature; and it is not unreasonable to believe, that their influence extends much farther than it has hitherto been traced.

(557.) Periodical and endemic diseases spring up, from time to time, in various places, of which the origin is involved in much obscurity. It is not unlikely, observes Dr. Watson, that they may depend upon some accidental cause analogous to that which gives rise to the ergotic gangrene. As a recent instance of such an endemic complaint, the cause of which has hitherto escaped observation, reference may be made to that remarkable distemper which began about four years ago in Paris, for the first time that it had been observed at all, and which, for several months during the spring and autumn, for two years in succession, affected a very large proportion of the population of that city. Its prominent and characteristic symptom, according to Andral, was pain of a peculiar kind, and often extremely severe in degree, in the hands and feet, and sometimes in other parts. From this, its principal feature, the complaint has been called *acrodynia*. After some time the

pain diminished, but the sensibility of the skin was found to be impaired, and the part was numb. Other symptoms supervened. The skin of the hands and feet often became red, and the cuticle then separated in large flakes; or large vesicles formed. In some cases the epidermis came off entire, retaining the form of the hand or foot, like a glove or sock. The skin frequently also became brown or black. Although no instances are recorded in which this epidemic proved fatal, yet it caused a great deal of suffering, and prevented numerous poor persons for a very long time from performing their labours.

(558.) Some of the symptoms of this singular disease are closely analogous to those which follow the use of spurred rye; and, occurring as it did, at a particular period each year, over a limited space, and chiefly, though not exclusively, in the crowded parts of the city, and amongst the lower classes of the people, the most probable solution that presents itself is, that it was caused by the use of some common article of diet, which had accidentally become depraved, or infected with an unwholesome quality.

(559.) Whether the *Italian cheese,* which has been already shewn to become, under certain circumstances, not only unwholesome, but poisonous, may, if eaten in small quantities, or in a less corrupted state, for a greater length of time, produce the symptoms above detailed, remains to be proved. The case, however, if so, would only be parallel to the two forms of ergotism before described, which are believed, by many physicians, to be attributable to such differences of administration.

(560.) In truth, the operation of this species of cause, in producing endemic and epidemic diseases, has already been traced in various parts of the world, although the subject has not received that full share of investigation which its manifest importance demands. The use of unsound maize has been known to produce, in some parts of America, very serious consequences. The degenerate corn is there known by the name of *mais peladero.* When it is eaten in considerable quantity, or for some time together, it is said to occasion the hair to fall off, and the teeth to become loose; but it causes neither convulsions nor gangrene. Fowls fed upon it lay eggs without shells. In some animals, in apes and parrots, for example, and in dogs and deer, it produces, when eaten, a kind of intoxication; and when taken more largely, it proves fatal. When swine eat it, which after a time they do with avidity, their bristles drop off, and their hind legs become feeble and wasted. Mules likewise lose their hair, and their hoofs swell. Now it is very curious, and not less important than curious, that, in the provinces of Neyba and Maraquito, in Colombia, where these extraordinary phenomena have been observed, the maize is very subject to the spur. This we learn from the investigations of M. Roullin, who, in tracing the abovenamed diseases to their cause, found a species of ergot to be very common, which converted the roundish grains into black pear-shaped bodies, not very unlike the spurs in European rye.

(561.) To conclude this subject, it may be observed, Dr. Willan held, that the "Morbus Hungarius, and some other diseases, reputed pestilential, might be added to the list of epidemics produced by ergot, or by a similar affection or degeneration of other grain." The sweating sickness, which occurred more than once in England in the beginning of the sixteenth century, was perhaps owing to some disease or depravation in the wheat, or to some noxious vegetable growing with it in

particular situations; for, although the disease extended itself chiefly over the northern counties, it neither affected the inhabitants of Wales nor of Scotland, who did not at that period eat wheaten bread. It was remarked by Schiller, (in his Treatise de Peste Britannicâ,) that birds at that time fell dead everywhere from off the trees, with small abscesses under their wings. This he refers to a poisonous quality in the air: but was not the effect (asks Dr. Willan) more probably produced by damaged grain taken as food, according to the result of the Abbé Tessier's and Dr. Roberts's experiments? [see § 549.]

(552.) *Rhizoctonidæ.* The last subtype included in the type Sclerotiaceæ contains *Rhizoctonia* and *Apiosporium*, among other less known and less important genera. The *Rhizoctonidæ* are distinguished from the other subtypes with which they are associated by having their peridia freely evolved, although connate with the sporangia. In some of the genera, such as *Apiosporium*, the sporidia are immersed and collected in the centre of the sporangium: whence Fries would form of them a group (*Apiosporidæ*), distinct from the true *Rhizoctonidæ*, in which there is no such central aggregation of the sporidia, and in which indeed the fructification is often obsolete. Such slight differences, however, do not seem to warrant the division, although the habits of Rhizoctonia and its nearest associates are peculiar, being chiefly subterranean fungi, parasitic on the root-fibres of other plants.

(553.) *Rhizoctonia*, as it has been named by De Candolle, is the *Thanatophytum*, or death-mould, of Nees. Both terms are peculiarly expressive of the destructive powers of the plant. It is found on the roots of the cultivated saffron; and so rapidly does it spread over whole fields, exterminating entire and extensive crops, that it is familiarly known to the French as '*la mort du safran.*' Its ravages are with the most certainty arrested by cutting a trench twelve or eighteen inches deep between the diseased and healthy tracts. This mode of staying the progress of the plague deserves especial attention, as it shews that, although so rapid in its march, its course must be subterranean; for, did the spores rise to the surface of the earth, to be carried by the winds from place to place, the trench would prove an ineffectual barrier, instead of the certain protection that it is known to be, when cut early and deep enough. The minute spores of these, and other subterranean fungi, are most probably conveyed from one situation to another, by the water which percolates the soil. That they are abundant in the ground of infected places, is proved by the fact, that the smallest quantity of earth, from an infected field, will ensure the propaga-

tion of the fungi; and, as it is said, even if the ground be not planted with saffron for twenty years afterwards. Smith states that this destructive parasitie has not been heard of hitherto any where but in France. The plague are of an irregular knobbed figure, from half an inch to an inch long, of a light reddish brown colour. Long capillary roots, or offsets, are sent out in every direction, which propagate the plague very extensively and readily. They attach themselves to the saffron, and, multiplying within the substance of the bulbs, soon destroy them.

(564.) These three subtypes, *Rhizoctonidæ*, *Sclerotidæ*, and *Erysiphidæ*, form, when associated, the type *Sclerotiaceæ;* the collective and distinctive characters of which are the following: Peridia contiguous to, and either connate, or confounded with the persistent sporangia. Sporidia more or less abortive, never pulverulent.

(565.) SPUMARIACEÆ. *Trichoderma*, *Onygena*, *Hyphelia*, and *Spumaria*, all curious and interesting, but not very important plants, give names, respectively, to four subtypes, included in the type *Spumariaceæ*. Collectively they are known by their spurious peridia being either membrano-cellular, or formed by flocci loosely interwoven; these *peridia* are fugacious, of an indeterminate figure, and the naked sporidia they enclose are crowded together, being rarely intermixed with flocci.

(566.) In the *Trichodermidæ* the peridium is sessile, roundish, floccose, or scaly and floccose; evanescent in the middle. Internal flocci none; sporidia compact and conglobate; thallus none.

(567.) In the *Onygenidæ* the peridium is generally subglobose, (yet the figure varies;) at first fleshy, afterwards flocculent and scaly. Internal flocci none; sporidia compact; thallus forming a stalk.

(568.) In the *Hyphelidæ* the peridium is sessile, subeffuse, indeterminate, formed of interwoven flocci, rarely smooth, fugacious. Sporidia crowded; and not intermixed with flocci.

(569.) In the *Spumaridæ*, which, like the previous subtype, have the peridia sessile, subeffuse, and indeterminate, these organs are very fragile, formed of cells, and sometimes covered externally with flocci. At first, the peridium in these plants is mucilaginous, subsequently evanescent. The sporidia are crowded, but intermixed with flocci.

(570.) *Onygena* is a curious fungus, only as yet found on horses' hoofs. *Spumaria* is perhaps the most familiar genus in the type, as, in the autumn, it is commonly spread over the leaves and branches both of dead and living plants, and has the appearance of frozen scum or froth.

(571.) Bovistaceæ. *Trichia* (the hair-mould), *Physarum* (the blister-mould), *Bovista* (the puff-ball), and *Scleroderma* (the hard-ball), are the normal genera of four subtypes, which, together, form the Bovistaceæ. Their most obvious distinctions depend upon their different degrees of firmness and solidity.

(572.) In the *Trichiadæ*, "the peridium is simple, and more or less fugacious; at first being *mucilaginous*, and subsequently becoming *membranaceous*. The sporidia are either scattered over distinct filaments, or collected together into tufts."

These are minute plants, chiefly found on the trunks of old trees and on decaying wood. Their forms are very various and beautiful. Some of them resemble the stamina of flowering plants, and others assume the forms of nets and sieves; whence indeed their names, *Stemonitis*, *Dyctidium*, *Cribaria*, &c.

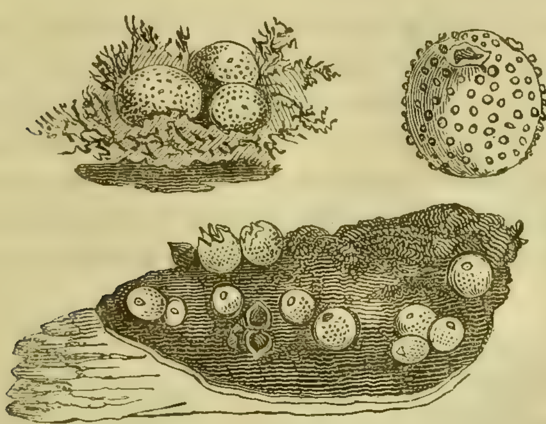
(573.) In the *Physaridæ*, "the peridium is at first pulpy, then paper-like, or crustaceous, persistent, and bursting at maturity, The sporidia are crowded, and irregularly interwoven with but few flocci."

Lycogala (the wolf-milk), is perhaps one of the best known British examples of the subtype *Physaridæ*. In an early state the pulpy peridium of this plant contains a mass of whitish matter resembling clotted cream. Like its allies, it is found on rotten wood and decaying leaves. The pulpy contents of these plants undergo some curious changes, both in consistence and colour, during maturation. The white or whitish clots of the *Lycogalæ* are converted into masses of fine brown powder of different shades, and absolutely impalpable; mixed with gum-water, they afford excellent pigments.

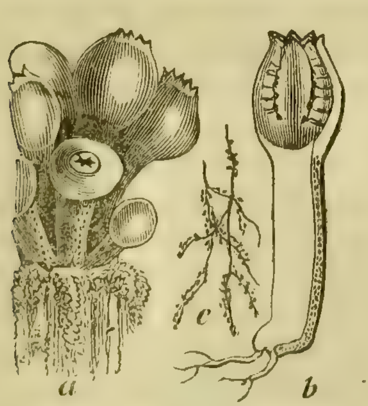
(574.) In the *Bovistidæ* (Lycoperdinei of Fries), "the peridium, at first of a soft fleshy consistence, subsequently becomes firm like leather. It is persistent and dehiscent, and always double; the outer stratum, however, cracking, and forming a scaly, warty, or powdery layer over the inner coat. The flocci are abundant, and woven together into a soft sporangium. The sporidia are attached to the flocci, not crowded together, but dispersed in equal groups."

(575.) *Lycoperdon* (the wolf puff-ball), and *Bovista* (the bull puff-ball), with *Geastrum* (the ground-star), are among the most important and curious illustrations that can be given of this subtype. The former genus is common on most of our heaths and pasture-lands. When the peridia burst, the sporules, which are

Lycoperdon pisiforme.



emitted in vast abundance, have something the appearance of smoke rising from the fungus; hence their common names of puff-balls, blindman's buff, or devil's snuff-boxes. The powder contained is curious, like that of the Lycogalæ, for the variations in colour it undergoes; at first the mass is white, moist, and spongy, subsequently it becomes dried and of a dirty green hue, and ultimately quite pulverulent and of a dark brown colour. This powder is further remarkable for its property of strongly repelling moisture. If a basin, says Keith, be filled with water and a little of



Lycoperdon pyriforme.

(*a*) Group of plants.

(*b*) Section of peridium, shewing the dehiscent apex.

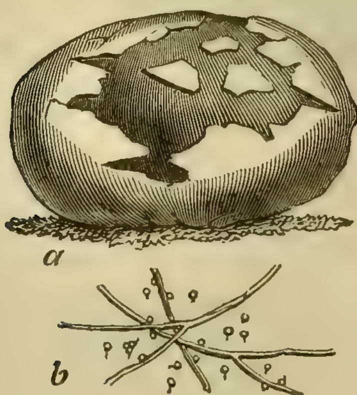
(*c*) Filaments, with sporidia attached.

Last figure much magnified, the others diminished.

the powder be strewed upon the surface, so as to cover it thinly, the hand may be plunged into it, and thrust down to the bottom, without being wetted with a single drop of water.

Lycoperdon Bovista [§ 578, fig. D, E, F, G,] is one of the largest species. *Lycoperdon pyriforme* is not a terrestrial plant, but grows in clusters on the trunks of old trees. These fungi have not been applied to any useful purposes.

(576.) Of the genus *Bovista*, the bull puff-ball, or, as it is called in some of our provinces, the frog-cheese, we have but two British species, one of which, the *gigantea*, is peculiarly interesting, both from the immense size that it occasionally attains, and also for the almost incredible rapidity with which it grows. In the museum of King's College, London, there are preserved several fine specimens, the largest of which measured, when found, between four



(*a*) *Bovista gigantea.*

(*b*) *Sporidia* and *filaments*, magnified; the outer layer of the peridium cracking into scales.

and five feet in circumference. They sometimes, however, reach a much greater size. Bulliard mentions having seen them above two feet in diameter, and affirms, on what he considers good authority, that they occasionally reach the enormous bulk of nearly nine feet in circumference.

It is probably the smoke that arises from these fungi when burned, or some of their allies, the Lycoperdons, which forms the secret method advantageously employed by some persons who keep bees, in order to stupify the insects without killing them, while their hives are being robbed of all their honey. Gerarde says, it is the common species of Lycoperdon, L. bovista, which the country people burn, to kill or smoulder their bees. If the bees are prevented escaping, they are of course destroyed; but,

otherwise, they quit their cells until the smouldering has ceased, leaving ample time to take away the honey.

In many places, and especially in our northern counties, these fungi are used instead of tinder; and "in some parts, where the neighbours dwell far asunder, to carry and reserve fire from place to place, whereof one species took the name of *Lucernarum fungus*." (Gerarde.)

(577.) An Italian species, *B. furfuracea*, which is said to be abundant on the heaths near Florence, is collected and sold in the markets, with some others of its allies, being an esteemed article of food.

Geastrum (the ground-star), shews the double peridium better than any other genus; all the outer stratum being separated from the inner in regular lobes. The species are extraordinary

Geastrum multifidum.

(*a*) Entire plant.

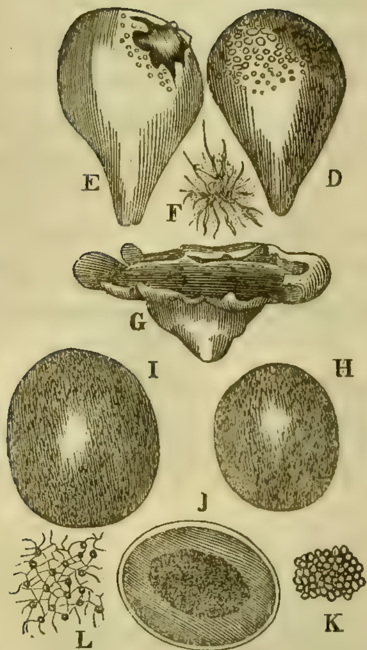
(*b*) Plant, with section of the internal peridium.

(*c*) Young plant in the act of bursting.

(*d*) Filament springing from peridium, and bearing sporidia.

plants as to their external structure; the resilience is so great in G. fornicatum, as to raise the body of the fungus upon arches formed by the elastic peridium; and the other Geastra, as coliforme and multifidum, well merit their names, 'stars of the earth.' These fungi shew a very near approach to the structure of the next section, especially in the peridia.

(578.) *Sclerodermidæ*. *Scleroderma* and its allies, *Diderma*, *Elaphomyces*, &c. form the last subtype of the Bovistaceæ. In these plants the peridium is corky, or even coriaceous, approaching the consistence of horn, persistent, and double. The outer stratum is, however, for the most part scarcely demonstrable, from its close connexion with the inner. The flocci are variously conjoined, forming and supporting spurious sporangiola. The sporidia are therefore often collected together.



D. *Lycoperdon bovista*, entire plant, with the outer layer of the peridium degenerated into scales.

E. Ditto, shewing the lacerated dehiscence.

F. Floccose filaments bearing sporidia.

G. Old fungus, after having discharged its spores.

H, I. Elaphomyces officinalis, with warty peridia.

J. Section, to shew the corky structure of the peridium.

K. Small portion of peridium magnified, to shew the warty coating.

L. Filaments with sporidia.

By the Germans one species of Elaphomyces, viz. the officinalis, is considered a medicinal plant.

(579.) Collectively, the subtypes *Sclerodermidæ*, *Bovistidæ*, *Physaridæ*, and *Trichiadæ*, form the type Bovistaceæ, (*Trichospermi* of Fries,) the last that occurs in the section Bovistinæ.

The following are the associating and distinctive characters of the type. "Peridium distinct, continuous, and of a determinate figure; including naked pulverulent sporidia, crowded amongst the flocci."

(580.) The types *Bovistaceæ*, *Spumariaceæ*, and *Sclerotiaceæ*, form, together, the section Bovistinæ, a section which includes four fifths of the plants ordinarily known as *Gasteromycetes*. This section is, perhaps, most readily distinguished by negative characters, viz. from the following section, by the peridia being not discrete in any of the types; for, even in Geastrum, it is only the outer layer that is free; the inner, if not both, being either concrete with the flocci, interwoven with the sporidia, or confused with the general mass of structure: and from the preceding section they are equally well known by their destitution of a nucleus.

TUBERINÆ.

(581.) Whether Tuber (the truffle), with its allies, *Phallus*, *Nidularia*, and *Carpobolus*, should be distinguished as a section, or only esteemed a type of the *Bovistinæ*, is a point not yet universally decided; but it is not one of very great importance. They are fungi, which, being just on the confines of the present order, foreshadow, by their structure, some of the organs which are characteristic of the next. Indeed, until lately, several of them were associated with the following order, the *Boletales*. Since, however, their structure has been better understood, it is evident that their closest affinity is with the *Bovistinæ* and *Sphærinæ;* from which, however, they so far differ as to give great sanction to the arrangement of those who elevate them to the rank of a co-ordinate section.

(582.) Nidulariaceæ. *Carpobolus* (the projector), and *Nidularia* (the nestlet), are the normal genera of two small subtypes included in the common type Nidulariaceæ. Conjoined, they are characterized by their "discrete peridia, and consequently, free sporangia;" their chief points of difference being the respective elastic and non-elastic dehiscence of their peridia: so that, in the one group, the sporangia are projected to a distance, and in the other, remain quietly within their nestlike pouches.

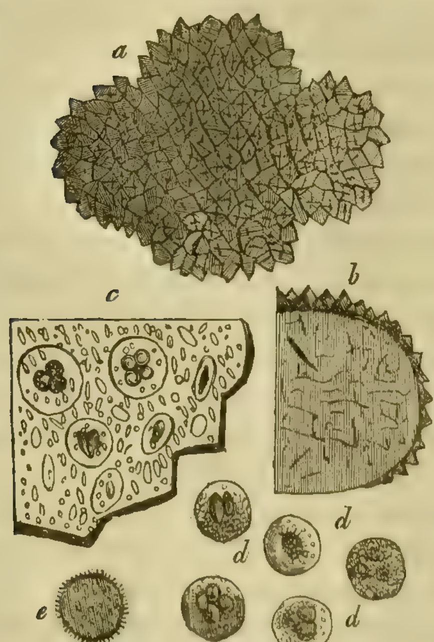
(583.) *Carpobolidæ. Carpobolus*, and its allies, *Sphærobolus*, *Pilobolus*, and *Atractobolus*, form that subtype which is distinguished by "the solitary discrete sporangium being elastically protruded from the peridium in which it was at first included."

These are very curious plants, as will be seen from the following abridged history of the Sphærobolus stellatus, which is given more at length by Greville. This remarkable plant, in its early state, is covered by a fine woolly or cottony web, that is very evanescent. When the young Sphæroboli have pushed through this web, they have the appearance of smooth round balls, rather larger than mustard-seeds. The outer peridium is of a firm fleshy texture, the inner membranaceous. This inner peridium, which is very tenacious, contains a single sporangium, or ball of sporidia. At the time of the dehiscence of the outer peridium, the inner one, then concave, with its mouth uppermost, with an inconceivable rapidity and force turns itself inside out, and projects the ball of sporidia,

like a bomb from a mortar, to a distance of several inches. So great is the force with which the ball is projected, that the cracking noise it occasions is distinctly audible; and frequently, besides the sporangium, the inner peridium, somewhat resembling a balloon in miniature, is shot forth likewise, and takes a short aërial voyage. "This is unquestionably," concludes Dr. Greville, "the most wonderfully constructed plant which it has fallen to my lot to describe in the Scottish Cryptogamic Flora. That so great a degree of force should exist in a body not larger than a pin's head, and that force exerted in defiance of considerable resistance, seems to surpass the power of anything to account for it satisfactorily."

(584.) *Nidularidæ*. *Nidularia* (the nest-mould), with its allies, *Myriococcum*, *Polyangium*, &c., are associated into a subtype, distinguished from the preceding by having their sporangia, although free, included within their peridia. They are elegant fungi; and not only do their open peridia resemble nests, but their sporangia may be likened to little eggs. In some, the sporangia are not invested with filaments; in others, the egg-like bodies appear as if packed in cotton.

(585.) TUBERACEÆ. The truffle (Tuber cibarium), so long and



Tuber cibarium.

(*a*) An entire fungus, shewing the irregular surface of the peridium.

(*b*) Section of the same, shewing internal structure.

(*c*) Ditto magnified, to shew the sporangiola, with the sporidia within them.

(*d* and *e*) Sporangiola separate.

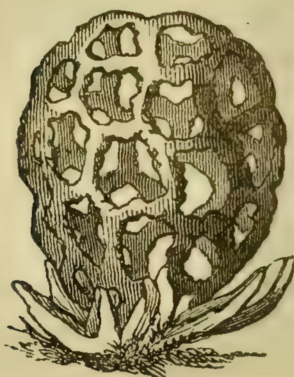
so much prized by epicures, that it has received the specific synonyme of *gulosorum*, will form the most familiar example of the type Tuberaceæ. The odour of these subterranean fungi is peculiar, and must be penetrating; for animals, such as pigs and dogs, are trained to hunt for them, and they are said unerringly to scent and indicate their prey, though covered by a stratum of earth ten or twelve inches thick. Even the human species appears to have sometimes an equally acute sense of smell developed; for, an instance has been recorded, in which a man hunted for, and discovered truffles, with a degree of success quite equal to that of the trained pigs and dogs.

(586.) *Tuber*, *Rhizopogon*, *Polygaster*, and their immediate allies, are associated together, and distinguished from the contingent types, by having their "sporidia enclosed in membranous sacs (*sporangiola;*) they are numerous, and contained within a peridium, which often assumes internally a veined or cancellated structure," foreshadowing, as it were, the hymenium of the following order; as the sporangiola may be considered forerunners of their asci.

(587.) Both the truffle (Tuber), and the root-beard (Rhizopogon), have been commended as articles of diet. The latter emerge from the soil, and somewhat resemble middling-sized potatoes lying on the surface. By most persons they would be considered scarcely esculent, were it not believed that they possess aphrodisiacal powers. It is probably a like unmerited fame which has contributed to keep the truffle so long a favourite, for its flavour is very trifling. Truffles vary much in colour, being found of almost every shade, from a deep brown to white. The dark sorts are the most esteemed. They grow, but not abundantly, in our midland counties; they are much more common on the continent, especially in the south of France and Italy, whence they are imported in considerable quantities into this country: they are indigenous also to the East Indies and to Japan. A light dry soil seems most favourable to their growth, but they are apparently most capricious plants, (*i. e.* we do not know the laws which regulate their transits;) for, notwithstanding their subterranean habitats, which might have been expected to have restrained their migrations, they wander from place to place, quite as much as any other individuals of this essentially nomadic class. Probably their spores are conveyed, like those of the Rhizoctoniæ, by the water that drains through

the soil; and perhaps they, and their hypogean associates, are destined to perform similar duties below, that epigean fungi do above, the surface of the earth.

(588.) PHALLACEÆ. *Clathrus*, *Laternea*, [§ 57, fig. C,] *Phallus*, [§ 57, figs. A. and B, § 590,] and their allies, afford examples of the gradual change of development which takes place towards the conclusion of this order, preparatory to the evolution of a new



Clathrus cancellatus,

Shewing the laciniate dehiscence of the peridium, and the cancellated structure of the receptacle.

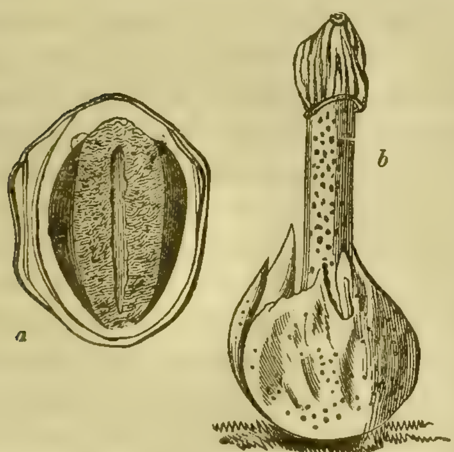
series of organs in the next; the peridium assuming the form of a volva, the column-like receptacle of a stipes, which is surmounted with a rudimentary pileus; and in some species, as in the Phallus indusiatus, [§ 57, A,] there is even a veil produced.

(589.) The Phalli, or stink-horns, are solitary fungi, growing frequently on rotten wood, at others, in the ordinary soil: they are peculiarly affected by meteoric changes, and towards the end of summer, and in the autumn, especially after thunder-storms, they are by no means very uncommon. But, from the suddenness of their growth, and the rapidity of their decay, they often pass through their ephemeral existence wholly without notice. Perhaps the strong and offensive odour of the most common species, far more disagreeable than putrefying flesh, may cause many rather to turn away from the spots where they grow, than to seek, by such a guide, for one of the greatest curiosities of the vegetable world. In its early stage, this strange fungus very much resembles an egg, both in shape and colour, [§ 590.] In this larva or nymph-like state it remains for two or three days, preparing for its subsequent metamorphosis. When fitted for its evolution, it suddenly bursts through its peridium, and attains, within a few hours, (varying from one to five,) its full growth, which is usually six or eight inches in

height, by two or three in circumference. Bulliard affirms that the rupture is so violent, as sometimes to be accompanied with a report as loud as that of a pistol; and that, if it be placed in a glass or earthenware vessel, just large enough to receive it, with a little water at the bottom, the vessel is broken when the volva bursts.

To explain this sudden and astonishing growth, the structure of the plants must be minutely examined; and, as Dr. Greville says, "in regarding this wonderful elongation, it is worthy of remark, that while the stipiform columella is confined within the volva-like peridium, the cellules, which compose the greater part of its substance, are so much vertically compressed as to make their parietes assume the form of short horizontal lines crowded together; but, on the other hand, when it is mature, the cellules are roundish." It is therefore to the vertical distention of numerous compressed series that this phenomenon must be, in great part, attributed.

(590.) *Phallus fœtidus*, the stinking Phallus, affords the most familiar British illustration. Previous to the rupture of the peri-



Phallus fœtidus.

(*a*) Young state included in peridium.

(*b*) Stipes, &c. after rupture, shewing the volviform peridium, the stipiform columella, and the pilei-form summit.

dium, this plant, which is subsequently so offensive, is perfectly scentless; but, immediately on its bursting, and on the escape of the lengthened axis, or stipes, the summit or pileus of which is covered with a dark-green viscid slime, the stench becomes intolerable. The slime, at first, is of considerable thickness, but, in the course of a few hours, it liquifies, and drops off, and the cells of the upper surface of the cap are then exposed.

This slimy substance, which exhales the odour peculiar to the plant, is likewise the receptacle of the sporidia. Flies are said to be so fond of this offensive matter, that it is always greedily devoured by them. They do not, however, resort to it for the purpose of depositing their eggs, as they often do, by an error of instinct, in other fungi, mistaking them for putrefying flesh; but for the purpose of regaling themselves on it as food. The fœtor arising from this plant, even when diluted by passing through and mixing with the air, is so great, that, as Greville says, "few persons will believe it to lose its offensive character, when held immediately under the nose." I can, however, add my testimony to that of Greville and Withering; and aver, that such as have the courage to smell it closely will find it less disagreeable than at a distance; for it then seems to have a slight pungency, like that of volatile salts. Hence, notwithstanding its disgusting odour has almost forbid my gathering it, I have carried the specimen home, by keeping it as near to my nose as possible, with little or no annoyance.

(591.) Their disagreeable smell has led some people to assert that their taste is nauseous likewise, and even to stigmatize them as being "*highly poisonous*." Persons, however, who are bold enough, may eat them without fear: Johnson says, the white part of the stalk is rather agreeable than otherwise. In Holland they are made into poultices, as a domestic remedy for rheumatism. The warmth of the application, and the slight stimulus of the ammonia the phalli contain, may render such poultices in some degree serviceable.

(592.) The Phallaceæ are characteristically distinguished by their discrete receptacles being protruded through the ruptured peridia, and by a mucous layer forming the nidus in which the sporidia are lodged.

(593.) The Phallaceæ, associated with the Tuberaceæ and Nidulariaceæ, form the common section *Tuberinæ*, (called by Fries the Angiogastres.) The collective and distinctive characters of the section will be found in "the sporidia being deposited in proper receptacles, distinct from the peridium."

(594.) The three sections last described, viz. the *Tuberinæ*, the *Bovistinæ*, and the *Sphærinæ*, constitute collectively the order

Tuberales. The characters of this order have been already given, in detailing those of its several sections; it now only remains to repeat them in a collective form, and to state that the Tuberales are fungi entirely closed; thus forming a pouch, (peridium or perithecium,) within which the sporidia and other organs are contained."

(595.) The following table affords a conspectus of the various types and sections included in the order, with references to their definitions.

Order.	Sections.	Types.
	Tuberinæ (593)	*Phallaceæ* (592)
		Tuberaceæ (586)
		Nidulariaceæ (582)
Tuberales (594)	Bovistinæ (580)	*Bovistaceæ* (579)
		Spumariaceæ (565)
		Sclerotiaceæ (564)
	Sphærinæ (532)	*Sphæriaceæ* (527, 532)
		Phacidiaceæ (525)
		Xylomaceæ (517)

BOLETALES.

MYCETALES, OR HYMENOMYCETES.

(596.) The most common eatable and poisonous fungi, known familiarly as mushrooms and toadstools, are associated, to form an order, which, from one of the normal genera (*Boletus*), is called the Boletales. Βωλίτης, *Boletus*, was formerly used to designate many, if not most, of the then known fungi belonging to this order, some of which are now called Agarics, and others have other modern appellations. Hence from it the order has been named, and its derivation from Βωλὸς, a field or pasture, still further strengthens its claim to give a collective title to the meadow mushrooms and their allies. *Hymenomycetes* is another name which has been given to this group: it refers to a peculiar structure common to the whole, which is denominated the *Hymenium*, [§ 600, fig. A. c.] It was probably to some of these plants that the old Greek word (*mykes*) μύκης, and the modern French *champignon*, or *field-pinion*, were originally applied, [§ 444]: hence *Mycetes*, or *Mycetales*, would be very fit collective terms, did not one, derived as above from a normal genus, afford a preferable denomination.

(597.) The genera contained in this present order are esteemed the only true *Fungi* by many writers; those which form the preceding orders being excluded, and called by other names. Such a scheme does not, however, appear to be advantageous either as an artificial index, or as a natural arrangement. Hence, the word Fungus is here used in its most familiar and extended signification, as the name of a large group or class, of which the *Boletales* or *Mushrooms*, the *Tuberales* or *Puff-balls*, and the *Mucedinales* or *Mildews*, are esteemed the constituent orders.

(598.) Several of the types in the preceding order not only prefigure, but so nearly approach the characteristic structures of the present, that the faintly drawn line of demarcation has sometimes included them in this division, and sometimes in that; so likewise it is found, in this present order, that the various types of its boundary section have the distinctive and peculiar forms so imperfectly developed, that their location seems questionable, and their present arrangement is founded rather on negative than on positive characters. The *Sclerotiaceæ* and *Phallaceæ* are examples of the first, the *Tremellaceæ* of the second, proposition.

(599.) These inosculations, it will be noted, are not peculiar to this or to any other order, but are common to all. The organs which are developed in the normal groups of the BOLETALES, are quite as peculiar and distinctive as those which characterize the preceding orders. But here, as there, although most distinct in the normal genera, the distinctions wane, and the strong contrasts disappear in the conterminal types and genera.

(600.) The external organs or members developed in these fungi are, the *volva*, or *wrapper* [fig. A, B, *a*, *a*], which supersedes the peridium and perithecium of the Tuberales. The *velum*, or *veil* [fig. A, B. *b*, *b*], which, when ruptured, becomes the *annulus*, *collar*, or *ring*, [fig. A, *b*; D, *a*; E, *c*; G, *c*]. In the early stages of growth, the veil covers the *hymenium*, or *fruit-fold* [A, *c*; B, *c*]; between the plates or within the pores of which are situated small lengthened cells or tubes, called *asci* [§ 614, fig. *b*]. The *asci* are present in most of the Boletales, and they contain, as in the sphærinæ, the *Sporidia* or *Spore cases*. The *hymenium*, or *fruit-fold*, is attached to, or forms part of, the *pileus*, or *cap* [A, *e*; B, *d*; D, *b*, &c.]; and the pileus, or cap, is often supported by a

stipes, or *stalk* [A, *f*; E, *a*, &c.], and the fleshy part is sometimes called its *receptacle*.

A. Agaricus imperialis (or Amanita muscaria), full grown. B. Ditto in a young state.

A, *a*. Volva, or wrapper, burst. (*b*) The veil become the ring or collar, annulus. (*c*) The hymenium. (*e*) The pileus, covered with warts formed by fragments of the ruptured volva. (*f*) The stipes.

B, *a*. The volva bursting. (*b*) The veil still attached to the edge of the pileus, and covering the hymenium. (*c*) The hymenium. (*d*) Section of the pileus, shewing the solid receptacle distinct from the hymenium. (E) Section of the stipes.

C. Spores.

D. Section of E, to shew the annulus (*a*); the solid receptacle (*b*); and the lamellated or gill-like structure of the hymenium (*c*.)

E. Agaricus campestris, full-grown. F. Ditto, in a young state.

E, *a*. Stipes. (*b*) Pileus. (*c*) Annulus. (*d*) Lamellated hymenium.

G. Another view of the same species, the references as in E.

H. A dried specimen of Agaricus pratensis, the common champignon.

I. A nodule of iron pyrites, having a fungöid shape.

(601.) In some of the more elaborately constructed fungi all these organs are present, but in others they are variously blended, or abortive; and upon the differences observable in their development the order has been distributed into sections, types, and genera.

(602.) When the centripetal and centrifugal forces are balanced, both the stipes and the pileus are equally evolved; but when either

predominates, the evolution of the axis and the radius are favored in turn. Thus, sometimes, the axis is inordinately developed, and the pileus assumes the form of the stipes, as in the *Clavariaceæ*. At others the pileus becomes unilateral; and again, when the radial force is further predominant, the stipes becomes altogether lost, as in the *Auriculariaceæ*, *Exidiaceæ*, and in many of the *Boleti*, and *Agarici*.

TREMELLINÆ.

(603.) Dillenius gave the name *Tremella* to an incongruous group of plants, which agreed in few other particulars than their gelatinous and tender substance, and the tremulous motions they exhibited on the slightest external agitation. Some of these misunderstood vegetables are fungi, some Algæ, and some considered such, are not plants at all. ence, as they were respectively examined by subsequent naturalists, the Tremellæ were arranged by one author, as by Linnæus, with the Algæ; and by another, as by Persoon, with the Fungi; while a third party, as Smith, perceiving their doubtful affinities, designated them Algæ ambiguæ. Those which are truly flags have been already described amongst the NOSTOCHINÆ [§ 149, *et seq*.]; those that are determined to be fungi will be included in the section TREMELLINÆ.

(604.) The former undetermined nature of these plants led many persons to doubt whether they were vegetables at all, which doubts were strengthened by various other matters being confounded with, and mistaken for Tremellas. Thus, Withering has shewn several specimens of supposed Tremella to be only the remains of frozen frogs; and others have been deceived into collecting, for these fungi, the jelly-like lumps of skin and bones which are disgorged by herons, and other birds. The above will shew the confusion in which these plants were formerly involved, and from which they have been rescued by the labours of modern mycologists. They will also serve as illustrations of the precious materials from which Paracelsus and other alchymists endeavoured to extract their boasted panacea, or elixir of life. Geoffrey states, that from these substances it was also hoped the universal solvent might be procured. The unknown being mistaken for the wonderful, the obscurity of these plants was considered decided evidence of some important mystery being concealed by them.

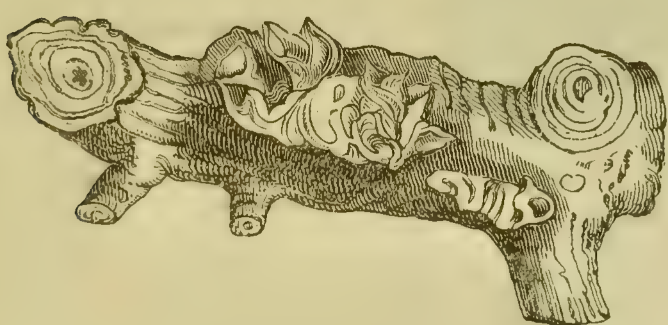
(605.) TREMELLACEÆ. *Hymenula* and *Tremella*, with their

respective allies, form two subtypes, the *Hymenulidæ* and *Tremellidæ*, which together constitute the type *Tremellaceæ*. Most of these plants are common, abounding on the trunks of trees, fallen branches, and decaying wood. By our foresters they are variously named, according to their forms and consistences, "Witch-guts," "Witch-meat," and "Witches'-butter."

(606.) *Hymenulidæ*. *Hymenula*, the normal genus of this subtype, has received its name from the circumstance of the complex structure prevalent in the order generally, being in it reduced, as it were, to the Hymenium alone, within which the sporidia, destitute of asci, are contained. The Hymenulæ, thus reduced to the simplest state possible in the Boletales, have a good deal the aspect of some sclerotia, especially Sclerotium durum; and hence they very properly bound the order. The distinctive characters of the subtype will be found "in the leathery or waxy consistence of the plants it includes, and in the sporidia being often obsolete."

(607.) *Tremellidæ*. *Tremella*, the quaking mould (from *tremo*, to tremble), and *Dacrymyces*, the tear-mould (from δακρυ, a tear, and μυκης, a fungus,) one of the wood-destroying fungi which commit such havoc among timber whenever allowed to gain a settlement, may serve as examples of the subtype *Tremellidæ*,

Tremella mesenterica.



which is most readily distinguished from the Hymenulidæ by the more gelatinous consistence of the receptacle; but the hymenium being naked, and mostly fruitful on both sides, forms the more important character. None of the Tremellæ are known to be

hurtful: they are very mucilaginous; and are said to be refrigerant; but, being devoid both of smell and taste, are not employed either as food or as medicine. Tremella mesenterica is reported to dye yellow, and T. fimbriata to afford another dye-stuff. These plants vary extremely, according to the soil and season in which they grow. On moist timber and in wet weather they are deliquescent, and resemble the Palmellæ and Nostocs; in droughts, they shrivel up, and become as scaly as Lichens. In general they are short-lived plants, disappearing in the course of a few weeks; but some species seem to be perennial. They are most common towards the end of autumn, and in the early part of spring. Some flourish during the winter.

(608.) The *Tremellidæ* and *Hymenulidæ*, sometimes considered as perfectly distinct groups, are here associated to form the type TREMELLACEÆ, of which the following are the diagnostic signs. "Plants gelatinous, waxy or coriaceous; *Hymenium* scarcely distinguishable from the other parts; so that it is sometimes equally fertile on every side, and sometimes the sporidia are obscure, if not abortive."

(609.) EXIDIACEÆ. The *Judas'-ear, Exidia Auricula Judæ,* is

Exidia auricula Judæ.

A. Two plants growing together.

B. Another reversed.

C. A section much magnified, to shew the hymenium.

a well-known example of the type EXIDIACEÆ, of which it is the normal genus, and to which it gives its name. The Exidiæ and

their allies, Lemalis and Hirneola, differ from the preceding and succeeding types, by having the receptacle, which is irregular and submarginate, fertile only on one side, and by the fructifying surface being superior.

(610.) The *Auricula Judæ*, which received its name from its resemblance to the human ear, was once held in much repute for its medicinal properties. It is an astringent; and, in the form of infusion or decoction, is said to be useful as a lotion in ophthalmia, and as a gargle in sore throats, accompanied with relaxation. A poultice made by steeping the fungi in milk or vinegar, has been also recommended as an external application, in similar cases.

(611.) CYPHELLACEÆ. *Cyphella* (the cave-stool), *Helotium* (the head-stool), and *Guepinia* (a genus so named in honour of M. Guepin), form, together, a small type denominated the CYPHELLACEÆ, which is distinguished from both the preceding, by having a dry membranaceous receptacle, with the hymenium inferior, and, consequently, being fertile only on the lower surface.

(612.) The three types *Cyphellaceæ*, *Exidiaceæ*, and *Tremellaceæ*, which differ among themselves by having superior, inferior, and amphigenous* or obscure hymenia, are associated by the following common characters, and form, collectively, the section TREMELLINÆ. These are membranaceous or gelatinous fungi, of a floccose structure. Shape irregular, hymenium confounded with the receptacle. Asci none.

(613.) The progressive evolution of the organs peculiar to the Boletales, and which are characteristic of the order, forms a curious subject for contemplation, even in the few stages through which it has in this section passed. At first, in the *Hymenulidæ*, the receptacle and hymenium are so blended together, that the whole plant may be esteemed to consist of the latter alone; for even the sporidia are sometimes absent; and no other organs are evolved. In the *Tremellidæ* the hymenium, notwithstanding it is confounded with the receptacle, is abundantly fertile of sporidia, fructifying in every part. In the *Exidiaceæ* and *Cyphellaceæ*, the receptacle and hymenium, though still confused and indeterminate, become somewhat more distinct, the fructification being restrained to especial parts; in the one to the lower, in the other to the upper surface; and furthermore, although in this section no asci

* Amphigenous, fruit-bearing on both sides.

are formed, the tubules in Exidia, from which the sporidia are elastically ejected, may be considered the forerunners of those organs, if they are not really their rudimental states.

HELVELLINÆ.

(614.) In the Helvellinæ, the asci, which are foreshadowed by the tubules of Exidia, and which are common in the Sphærinæ or Pyrenomycetes, but which are unknown in the Bovistinæ, Tuberinæ, and Tremellinæ, again appear, and are fully and generally developed, forming an important diagnostic sign. Their presence in the *Sphærinæ* has led some botanists to associate those fungi with the *Boletales*, under the name of ASCOMYCETES; while the sections *Tuberinæ* and *Bovistinæ*, with respect to their destitution of asci, and being simply sporidiferous, have been contrasted, and termed SPOROMYCETES. Such a distribution is, however, very faulty; for, not only are other fungi, such as the *Phallaceæ*, more closely allied to the *Boletales* than are the *Sphærinæ*, but the whole of the *Tremellinæ*, and part of the *Clavariaceæ*, which are included among the ascomycetes, are entirely destitute of asci;

Helvella leucophœa.

(*a*) An entire plant.

(*b*) Portion of the superior hymenium with the asci, containing the sporidia.

(*c*) A section of the stipes.
Grev. 143.

and hence, if such a scheme were truly followed, would be severed from their natural allies, and associated with the Mucedinales, and other sporomycetes. These speculative systems are worthy no-

tice, as affording different views of important objects, which can never be contemplated from too many points; but if such views alone were taken, they would give very imperfect and partial glimpses of any science.

(615.) The Helvellinæ have been separated, by Fries, into two groups of equal rank; but, notwithstanding a strong desire to hold as closely as possible to his arrangement, the distinctive characters, as given in his '*Systema Orbis Vegetabilis*,' a most admirable and very learned work, do not seem to justify the division, and therefore it is not here adopted.

(616.) The *Helvellinæ* are distinguished from the preceding section, the Tremellinæ, by being *ascigerous;* and from the succeeding section, the Agaricinæ, by not having an inferior hymenium. The latter part of the definition used until lately to be expressed in the positive form, the hymenium being described in the Helvellinæ as *superior;* but Fries has endeavoured to distinguish a modification of the superior hymenium, which occurs in Clavaria [§ 620], and its allies, from that form which is common in Helvella, Peziza, &c. The latter alone he allows to be superior, the former he denominates *amphigenous;* a term which indicates a duplex fructification. But although, in some of the Clavariaceæ, the whole of the club-shaped receptacle is covered by the ascigerous hymenium, and the pileus and stipes are undistinguishable; in others, there is a head separate from the stem, and the hymenium is confined to the upper end; a position equivalent to that of the hymenium in Helvella, and differing no more from that normal genus than does its position in Peziza. In *Peziza* the centre of the receptacle is depressed, and the hymenium is contained, as it were, in a cup, while in *Clavaria* the centre is elevated, and the hymenium becomes spread over the superior or outer surface of a club. In the Tremellaceæ alone does the hymenium appear to be truly amphigenous.

Helvella leucophœa and H. mitra, are both esculent; indeed none of the Helvellinæ are noxious.

(617.) Clavariaceæ. The branching or club-shaped forms of the Clavariaceæ, combined with their often polished and coralline appearance, led the older naturalists to consider them not fungi, but to associate them with the corals which were then esteemed vegetables, and denominated *Lithophytes.* Even so late as the time of Tournefort this error prevailed; and it is to Holmskiold and Persoon that we chiefly owe our present knowledge of the

true nature of these plants. The type to which Clavaria gives the collective name includes three subtypes, the *Pistillaridæ*, *Clavaridæ*, and *Mitrulidæ*, which are associated by the following characters, which are common to the whole, "receptacle elongated, with a tendency to a cylindrical form, sometimes simple, sometimes branched, not margined. Hymenium superior, (in the state called by Fries amphigenous,) asci mostly present, fixed."

(618.) *Pistillaridæ*. Pistillaria and its allies, which are the least removed from the Tremellinæ, partake more of their characters than do any of the other Clavariaceous fungi; for, although sometimes horny, they are often of a soft waxy, or jelly-like consistence. The asci are likewise very obscure, and frequently, if not always, obsolete. In the normal genus the naked sporidia emerge at the end only, although the whole surface is covered with the hymenium. In Typhula, which has been so named from its resemblance to the reed-mace, the hymenium is confined to the extremity of the club, and the asci, though not abortive, are very obscure; and hence it has been sometimes described as having none.

(619.) It has probably been owing to different mycologists examining specimens of these plants in more or less perfect states, that the discrepancies have occurred which so much vary the genera associated in each subtype; some putting *Calocera*, the fair-horn-mould (from καλος fair, and κερας a horn), along with *Pistillaria*, in which the asci are obliterated, and others, along with *Clavaria*, in which they are most distinct.

(620.) *Clavaridæ* In CLAVARIA, and its allies, *Gomphora*,

(*a*) Plant of Clavaria cristata, lessened.

(*b*) Portion of stem transversely divided.

(*c*) ——— of hymenium, shewing thecæ and sporidia magnified.
Grev. 190.

Hericium, &c. "the asci, which are distinct, are short, and the receptacle and hymenium are confluent." The hymenium, as in

Clavaria, often covers the entire surface. Hericium and Gomphora are separated from Clavaria by Fries, and formed into a distinct group.

(621.) All the *Clavariæ* are esculent, and some are much esteemed as food. *Clavaria rugosa* is commended by Sowerby, for its "agreeable taste, like that of the common mushroom; *Clavaria flava* is said to be delicious; and *C. pyxidata* tolerably good. *C. cinerea* is, however, the species most frequently eaten on the continent, yet, probably only from its being more abundant than *pyxidata*, *rugosa*, *flava*, and *corallöides*. In Italy these plants are called '*Ditola rosea*,' *bianca*, &c., referring to their colour; and in France, *barbe de bouc*, *espignelles*, and *diables*. According to the accounts given by Persoon of the continental mode of cooking these fungi, it would be strange indeed if they, or any other innoxious matters, were not edible. He says they are "stewed for an hour with butter, pepper, and salt, and then put into a gravy sauce, or a fricassee of fowls."

> "The pungent mustard and the hot cayenne,
> Will palatable make the tough old ewe."

Loureiro, when travelling in China, found an eatable species of Clavaria growing upon elephant's dung.

(622.) *Mitrulidæ*. *Mitrula* (the mitre-mould), *Spathula* (the spathulet), and *Geoglossum* (the earth-tongue), afford three admirable examples of change of shape, the last-named being simple, and like a tongue or club, the second flattened, and the other severed into two branches, like a mitre, thus approaching the ramified structure of some of the *Clavariæ*, [§ 620.] The above genera are associated, and the subtype distinguished by having the hymenium discrete, and the asci long. The hymenium likewise is only terminal, and the head is separate from the stem.

(623.) PEZIZACEÆ. *Pezita* and *Pezica* (from πεζίτης and πεζικὸς, a traveller on foot), are old names given by Pliny to a group of fungi not elevated on stalks; such as with us are often called *footless stools*. The modern word, *Peziza*, is a corruption of the latter term, and is applied to designate a very large genus, which, having been distributed into several subgenera, will probably hereafter be considered a subtype. At present, however, the genus *Peziza* had better remain entire; for, although several schemes have been proposed for its subdivision, their diagnostic

signs do not, on the whole, appear sufficiently important to demand its disintegration.

(624.) The most important genera associated with Peziza in the type Pezizaceæ are *Stictis* (the sunk-mould), and *Ditiola* (the down-rot.) These two genera give names to two of the subordinate groups of the *Pezizaceæ*, which it has been proposed to distinguish from the more immediate allies of Peziza.

(625.) Fries states that in the first group (the *Stictidæ*), the receptacle is obliterated, and the hymenium immersed.

(626.) That in the second (the *Ditiolidæ*), the receptacle is sublenticular, and never closed.

(627.) That in the third (the *Pezizidæ*), the receptacle is cupulate and closed during early growth.

(628.) In all the hymenium is margined; and, this combined with the character derived from the shape of the receptacle, which, although various, is never pileiform (cap-like), will constitute the diagnostic signs between the Pezizaceæ and the following type.

(629.) The *Ditiolæ* are gregarious fungi, which grow in profusion on various kinds of immature timber, especially on deal and on barked fir-trees. They are of a firm structure and inodorous, and are remarkable for flourishing upon, and aiding in, the destruction of dry timber. Their minute fibrillæ pierce between the fibres of the wood, separate and soften them, and bring on a premature decay; for, the further they insinuate themselves, the more easily can moisture gain access; and, as the successive crops of spores become developed within these chinks, larger and larger clefts are made. A species of *Ditiola*, the *radicata*, is one of those wood-destroying fungi which are commonly known as *dry-rot*.

Fungi such as these, which penetrate through bark and wood, or others, the spores of which being absorbed by the roots, are conveyed into the very heart and diffused throughout the entire substance of the vegetable body, where, when it is in a weak or sickly state, they germinate and grow—have a power of disintegrating timber, and rending the trunks of even the strongest trees, of which persons, not accustomed to watch their progress, can form but very faint conceptions. Perhaps the following two accidental expreiments may give some, though a very imperfect, idea of the force with which they act. At different times, several of the stones in the pavement in the town of Basingstoke were observed, day by day, to be rising gradually from their beds, until they were some

inches above the ordinary level; under one of these, which weighed seven pounds, a large mushroom was found, that measured a foot in circumference. It is now in the possession of J. Simonds, Esq.* The other case is recorded by Mr. Joseph Jefferson; who says, a toadstool, six or seven inches in diameter, raised a large paving stone an inch and a half out of its bed; and the mason, who had the contract for paving, was much enraged at the idea that a weak fungus should have lifted so heavy a weight. But his uneasiness was much increased, and even his alarm excited, when, about a month after the injury had been repaired, the adjoining stone was elevated in a similar manner, and two mushrooms, not quite so large, were found beneath it; for it seemed doubtful whether the whole town of Basingstoke might not want re-paving during the term of his contract. The stones were nearly of the same size, each being about twenty-two inches by twenty-one; the last raised being tried, weighed eighty-three pounds. How great then must the distensile and rupturing power of fungi be, that grow, and distend themselves within the trunks of trees, and of other weaker plants!

(630.) *Peziza*, the normal genus, is the largest and most important included in the type. It consists of 300 species, which have been distributed into the four subgenera, *Aleuria*, *Lachnea*, *Phialea*, and *Helotium*. *Peziza* (or *Lachnea*) *coccinea*, is a most splendid fungus. In beauty of form and richness of colouring, it is second to none. The interior of the cup is of the finest carmine, the outer surface white and downy. Greville says, "without much poetical exaggeration, this beautiful Peziza seems to be clothed with a fur robe lined with the richest velvet." It is truly one of

> "The beauties of the wilderness,
> That make so gay the solitary place,
> Where no eye sees them."

(631.) Peziza æruginosa is also a remarkable species. Its colour is of a deep verdigris green, which is of equal intensity throughout its whole substance; it possesses the curious property of staining the wood upon which it grows to the depth of two inches or upwards, of the same colour with itself. Greville observes, that this extraordinary property forms a most useful character of the *Peziza æruginosa*; for, so variable is it in other

* Basingstoke; July 3, 1830.—*Hampshire Advertiser.*

respects, that even its genus has been considered doubtful. Such pieces of discoloured wood are not unfrequently met with in groves and forests; some of the larger masses, however, which are stained green throughout, probably owe their discolouration to some other cause.

(632.) The *Pezizæ*, in general, are of a tough leathery consistence, and not esteemed as food. Persoon, however, says that the larger ones, dressed in the same manner as the Morels, may be eaten without fear. The Pezizæ emit their smoke-like sporules from their cupped receptacles, in the same manner as some of the Lycoperdons.

(633.) HELVELLACEÆ. Small savoury potherbs were by the ancients called Heluellæ (or Helvellæ), a word derived from *helluo*, a glutton, or the verb *helluor*, "to gormandize," because they stimulate the appetite. The same term appears to have been applied by Cicero to certain sapid fungi; whether or not to our modern eatable Helvellæ, is unknown: but, however this may be, the name has been adopted, and is peculiarly fitted for the common denomination of a type which contains some of the most delicious mushrooms that epicures desire, and to encourage the growth of which whole forests have been burned.

(634.) *Morchella*, *Verpa*, and *Leotia*, are genera associated with *Helvella* to form the type HELVELLACEÆ. They agree in having a pileiform or cap-like receptacle, which is never closed. The hymenium also in these plants is immarginate.

(635.) Helvella, as now generically defined, does not include fungi so much prized by modern epicures as the allied genus *Morchella:* some few, however, are still esteemed. *Helvella crispa*, is said to be excellent as an article of cookery. *H. lacunosa*, which is often confounded with it, although edible, is by no means so good. *H. esculenta* has a fine flavour, and is frequently substituted, and commonly eaten for the true morel; but it is far inferior to that celebrated fungus. Its qualities are nearly the same as those of the morel; and it is popularly confounded with it in Sweden, Germany, and other places. In Sweden both are called, indifferently, *Stenmurkla*, and in Germany, Gemeine Morchel, and Stockmorchel. *H. infula*, the true H. mitra of Ruppius and the older botanists, is also esculent; indeed, none of the species are poisonous, or in any respect hurtful: but, with the exception of those above named, they are in general insipid and

inodorous. The Helvellæ are permanent, somewhat fragile fungi, growing upon the earth, or upon very wet wood, and are chiefly found in the autumn.

(636.) *Verpa* is the connecting link between this type and the preceding, through the genus *Vibrissea* of the *Ditiolidæ*, to which, according to Fries, it is allied.

(637.) *Leotia* is a name given by Sir John Hill, without any known reason, to a group of fungi which, like their allies, are innoxious, and, in general, devoid both of smell and taste. Hence they are not eaten, with the exception of one species, the *L. amara*, a native of Cochin-china, which is said to be deprived of its bitterness, and rendered eatable, by long stewing. (*Loudon.*)

(638.) *Morchella*, a name formed by Dillenius, from the German *Morchel*, designates the genus in which the delicious *morels* are found. *Morchel* seems to be derived either from *mörk*, a word signifying *dark*, in the dialect of Lower Germany, or from the German *moor*, a moor or morass. There are several species of morel, none of which are poisonous, but some are barely esculent, while others are most grateful to the palate; and others, again, so vapid and watery, and so soon becoming fœtid, as to be wholly unfit for food. *Morchella esculenta*, *patula*, and *deliciosa*, especially the latter, are the species most esteemed. As condiments, they are among the most valuable of the fungi. They are seldom eaten alone, or cooked when fresh, but are dried; and may thus be preserved for months, and even years, and are employed from time to time as an ingredient in soups and sauces. Persoon, however, commends them when stewed for an hour with butter, pepper, salt, parsley, and ham, in a good gravy; when nearly done, the yolks of a few eggs should be added, and a little cream: they are served either by themselves, or on a buttered toast. Paulet gives directions for stuffing morels with savoury viands, such as pickled pilchards, craw-fish, the flesh of fowls, &c. and says, after they are broiled, they are to be served up with champaigne, lemon-juice, and bread-crumbs.

The German peasants, who found it a profitable employment to collect morels, having observed that they grew most freely and abundantly in those places where wood had been burned, absolutely set fire to the forests in many places to favor their propagation; and to such an extent did this injurious practice

proceed, that it became necessary to enact severe laws for its suppression.

(639.) The three types *Helvellaceæ*, *Pezizaceæ*, and *Clavariaceæ*, now illustrated, associate to form the section HELVELLINÆ, a section which includes the *Elvellacei* and *Clavati* of Fries, which although only subordinately distinct, are primarily severed by him for the reason already given. The superior ascigerous hymenium, occasionally assuming the amphigenous form, is the common character in which these types agree, and by which the section is distinguished from those that precede and follow.

AGARICINÆ.

(640.) As the RHA, or *Wolga*, gave its name to several species of Rhubarb, (*e.g.* the RHA-*barbarum*, RHA-*ponticum*, &c.) so from AGARUS, a river in Sarmatia, the name AGARIC (Agaricus, ἀγαρικος) was derived, and given to certain fungi that were common on its banks. It is more than probable, from the descriptions of Pliny, that the ancient Agarics of Sarmatia were identical with some of the species still included in the modern genus Agaricus, the most extensive and important in the section to which it affords a collective name.

(641.) Amongst the AGARICINÆ will be found examples of the most highly developed fungi known; plants in which the scheme of construction prevalent in the class appears in its most elaborate and perfect forms. Agaricus and Boletus are indeed the normal genera from which all the others may be considered as deviating groups; some tending towards the lower Algæ, and some towards the Lichenales, while these are unlike anything out of their class.

(642.) The *Agaricinæ* are distinguished from the two other sections, in the order *Boletales*, by having their hymenia distinct, ascigerous, and *inferior* characters peculiarly differential, and contrasting strongly with the *superior* ascigerous hymenia of the Helvellinæ and the confused sporidiferous hymenia of the Tremellinæ.

(643.) Three types are included in the section AGARICINÆ, of which *Auricularia*, *Boletus*, and *Agaricus*, are the normal genera; and hence they are called *Auriculariaceæ*, *Boletaceæ*, and *Agaricaceæ*. Fries has formed a fourth group, by associating part of the

Boletaceæ with *Radulum* of the *Auriculariaceæ*, but excepting that, by this, his quaternary scheme is completed, no reason can be offered for separating Fistulina so far from Boletus, of which genus it was once considered to be a species.

(644.) Auriculariaceæ. *Auricularia*, the *ear-stool*, with *Radulum*, *Thelephora*, and *Stereum*, form the type *Auriculariaceæ*, the distinctive characters of which will be found in the structure of the hymenium; for in all it is either tuberculate, papillose, or smooth.

(645.) Were the genera numerous that are included in this type, three subtypes might be formed from the above-named variations in the structure of the Hymenium. *Auricularia*, *Stereum*, and *Coniophora*, in which the hymenium is smooth, might be associated as the *Auricularidæ;* while *Thelephora*, in which it is subpapillose, and *Radulum*, in which it is tuberculate, might be esteemed the normal genera of the *Thelephoridæ* and *Radulidæ*. But, although both *Thelephora* and *Auricularia* contain several subgenera, or tribes, any further division is not at present essential, and therefore not to be commended.

(646.) Boletaceæ. *Hydnum* and *Fistulina*, *Polyporus* and *Boletus*, *Dædalea* and *Merulius*, which, with various other allied genera, are included in the type Boletaceæ, afford examples of an interesting series of structural gradations, that connect the tuberculate, papillose, and smooth Auriculariaceæ, with the plicate and lamellate fungi of the following type.

(647.) In *Hydnum*, and its allies, *Irpex* (the rake-stool), and *Fistulina* (the pipe-stool), the hymenium is subulate. In *Boletus*, and its allies, *Polyporus* and *Porotheleum*, the hymenium is porous. In *Merulius* (the wood-rot), and *Dædalea* (the maze-stool), the hymenium is sinuate.

(648.) These therefore are the collective characters of the type, which is thus distinguished from its co-ordinates, by having the hymenium either subulate, porous, or sinuate.

(649.) These gradations of structure may be considered characteristic of three subtypes, as they certainly are of three stages of development; but, although the Boletaceæ may thus be distributed into the minor groups *Hydnidæ*, *Boletidæ*, and *Merulidæ*, still these pass so insensibly into each other, that the distribution is the very reverse of a division. The discrete pipes of the hyme-

nium in Fistulina shew the close connexion of the *Hydnidæ* with the *Boletidæ*, by the concrete tubulous pores of *Boletus;* and the simply porous hymenium of *Polyporus* passes into the sinuous hymenium of *Dædalea;* both being still farther alike, in having the pileus and hymenium concrete and homogeneous.

(650.) *Hydnidæ.* The Hydna (*ὕδνα*, or *ὄϊδνα*, of the ancient Greeks), would appear to have been tuberiform fungi, and the term *hydnum* (or *ὕδνον*, from *οἰδέω*, to swell,) to have been equivalent to the tuber of the Romans, and our truffle. It is therefore probable that this name was not applied to any of the species included in the modern genus, many of which are of a loose, bristly, and flocculent form, often resembling spines, or dishevelled hair.

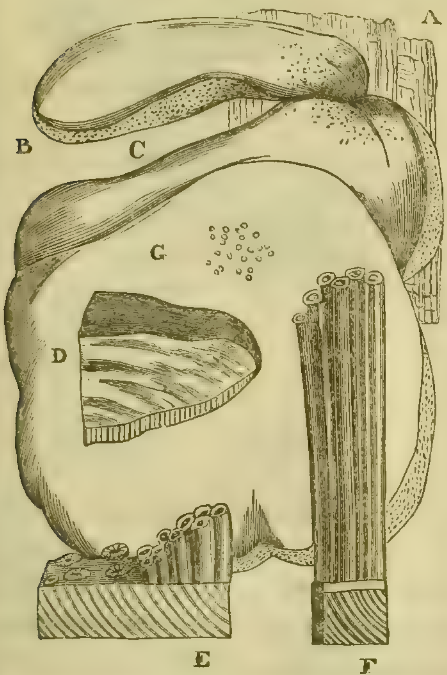
(651.) The subulæ forming the hymenium in these plants, and whence they have been popularly called spine-tools, prickle-stools, &c., are often of considerable length, giving to some a mock-formidable appearance, which, perhaps, led the old herbalists to consider them noxious plants; although there does not in reality seem to be much occasion for Gerard's sarcastic caution, who said, when some continental visitors recommended their use as food,

"I give my advice to those that love such strange and new fangled meats, to beware of licking honey among thorns, lest the sweetness of the one do not countervaile the sharpness and pricking of the other."

Paulet mentions a poisonous *Hydnum*: in general, however, the *Hydnidæ* are innoxious, and several of the genera afford species that are esteemed as food. Those of a dark colour, De Candolle states, are to be more or less suspected. *Hydnum erinaceum* (the hedgehog prickle-stool), which is found growing upon old oaks, forms a common article of food in the Vosges, a range of mountains separating Lorraine from Alsace. *Hyd. corallöides* is eaten in Piedmont and Tuscany, and the *H. Caput Medusæ* in other parts of Italy, under the name of *Fungo istrice. H. repandum* is likewise esculent, as are also *H. leoninum*, a native of Sweden; and *H. auriscalpium*, which is indigenous to this country, growing on the cones of fir-trees. *Hydnum album* has somewhat the flavor of the Chantarelle.

(652.) *Fistulina hepatica* (the liver *Fistuline*, or pipe-stool), which is parasitic upon the trunks of old oaks and other trees, is another eatable species, which on the continent is generally esteemed. It is very similar to a piece of bullock's liver; and, when cut into,

it is beautifully marbled with red and white streaks, something resembling a fine piece of beef. In France it is called *Foie de bœuf*, *Langue de bœuf*, *Glue de chêne;* and in Tuscany *Lingua di castagno;* all names indicating a common agreement as to its flesh-like appearance: and it is said, when cooked, to have also an



A. Piece of old oak-bark from which spring

B and C. Two lobes of the liver fungus, Fistulina hepatica.

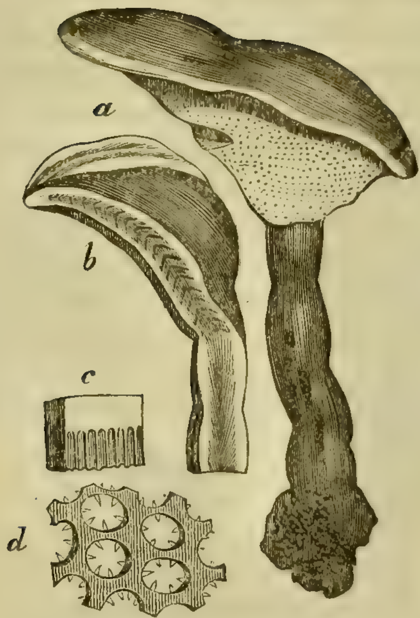
D. Section of the pileus, to shew the receptacle and hymenium.

E, F. Smaller portions more enlarged, to shew the discrete tubulous subulæ, of which the hymenium is composed.

G. Spores magnified.

animal flavor. It is the only known species in the genus; the old writers on materia medica called it Hypodrys.

(653.) Until lately, *Fistulina*, and many other fungi, were included in a common genus with those species which alone are now considered to be true Boleti. Their differences in structure are, however, so great, that modern science could not allow them to hold a common generic name. For example: in Boletus, the hymenium [§ 655, *c*, *d*,] which is formed of a stratum of connected tubules, is discrete from the receptacle of the pileus; in Fistulina, the hymenium, although discrete, is subulate, the fistulous subulæ being loose, [§ 652, E, F;] while, in the majority of the species, the hymenium is not discrete, but forms a homogeneous stratum with the receptacle, and is simply porous, the pores being sometimes deep, and sometimes very superficial. Fistulina is the name given to the *pipe-stool;* Boletus is retained for the normal species; and



Polyporus lucidus.

(*a*) Entire plant (reduced.)

(*b*) Section of stipes and unilateral pileus.

(*c*) Porous structure of the hymenium.

(*d*) Transverse section of the pores, shewing the asci.

those which are punctured, and have many pores, are called Polypori or Polypores.

(654.) *Boletidæ.* De Candolle observes, as a general rule, that the stalks and the flesh of the pilei are edible in the Boletidæ. The following are the exceptions to this rule: 1°, The coriaceous, corky, and woody species. 2°, Those species which have the stipes furnished with a collar, or annulus. 3°, Those which have a peppery flavour; and 4°, Those which become of a blue or greenish colour when cut. This last character is an important one in all the fungi; for it invariably denotes a suspicious quality. The Russians employ those Boleti for dyeing, which change to a blue or green colour when cut.

(655.) *Boletus esculentus*, *subtomentosus*, and *granulatus*, are all eatable, but not so much esteemed as *Boletus edulis*, which is very common in France, and said, when dressed, to be excellent. In Hungary a soup made from this Boletus is considered a delicacy. *Boletus scaber* is a favourite food among the Russians and Poles, who, as Sowerby was informed, have many ways of cooking and pickling it. Several other species are also eaten on the continent, such as *B. æreus* and *chrysenteron;* the latter of which De Candolle states to be wholesome when young, but to become

noxious, or at least suspected, when mature. *Boletus luridus*, the most splendid species in the whole genus, is at the same time the most deleterious: it is one of our most poisonous fungi. *Boletus*

Boletus luridus.

(*a*, *b*) Entire plants, of different ages.

(*c*) Section, to shew the extent of hymenium.

(*d*) To illustrate the arrangement of the tubes.

Grev. 121.

purgans, the old *B. laricis*, has been recommended as a cathartic; its action is violent, and it is seldom, if ever, used.

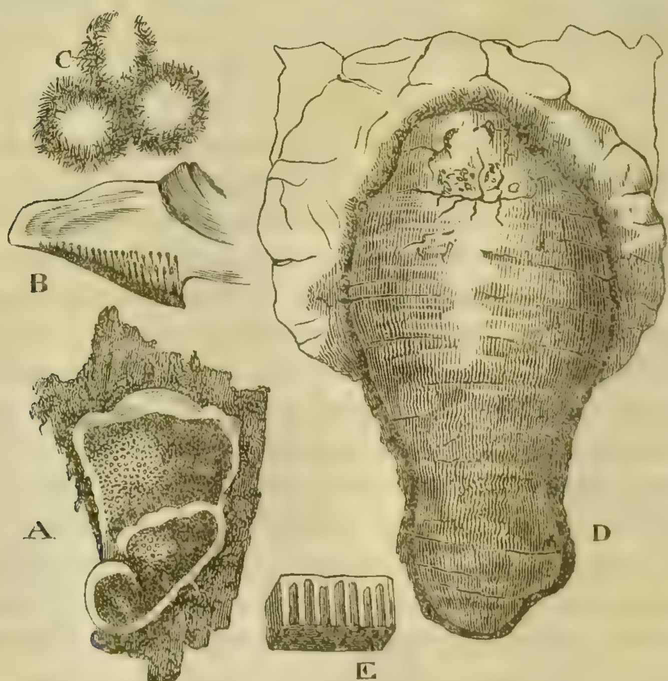
(666.) Although, in different countries, several species of Polypore are considered alimentary, and one very highly esteemed, they are not, in general, enumerated amongst the esculent fungi; the majority, if not absolutely poisonous, affording unwholesome food. Indeed, *Polyporus squamosus*, which is said by Wulfen to be eaten in Carinthia, and which in France is called *Miellin*, *Langou*, *Oreille d'orme*, &c., has several times proved injurious to those who have partaken of it. *P. frondosus* emits an odour, which, if the fungus be kept in a close chamber, is highly dangerous, as Bulliard experienced in his own person; and, although it is eaten in Piedmont, long exposure to heat, and a tedious process of cookery, are essentially requisite to lessen or remove its noxious properties.

(667.) De Candolle gives the following rule as diagnostic between the harmless and poisonous polypores. The sessile species, or those having lateral pedicles, *i. e.* the pilei springing from one side of the stipes only, are to be suspected, for most of them are

venomous; while those which have a central stipes are harmless, and some of them eatable.

The before-named celebrated botanist has cited the P. squamosus and P. frondosus, both of which have lateral pilei, as exceptions to his rule; but they seem rather to be confirmatory of it [vide § 666]; and, furthermore, the celebrated P. tuberaster, which abounds in the Neapolitan and Papal states, and two other species, which Micheli says are eaten in Tuscany, all have central stalks.

(668.) Several of the Polypori are possessed of more or less important medicinal virtues. *Polyporus igniarius* has long been famed as a styptic; *P. annosus* is reported by the Swedish peasantry to be a cure for snake-bites; and *P. officinalis* is enumerated by the Germans as one of the articles in their extensive list of vegetable medicines: its action is cathartic. Amadou, or German tinder, is made from the *P. igniarius,* by separating the porous hymenium from the harder parts, and steeping it in a solution of nitre, after it has been beaten into a soft and spongy state. Various other species of Polyporus, besides the igniarius, as the *hispidus,* &c., retain fire when dry, and are also collected and used as amadou. The Laplanders have long been in the habit of employing these, and other fungi, for



Polyporus officinalis.

A. Two Polypori growing together, and reversed, to shew the inferior porous hymenia. B. Section, to shew the receptacle and pores. C. Transverse section of pores, shewing the numerous asci. D. Entire plant, front view.

the same purposes, and in a similar way, as the natives of Japan and China do the moxa. Whenever they suffer from pains in their limbs, they bruise some of the dried fungus, or amadou, and, pulling it to pieces, put a small heap of it on the part nearest to the seat of the pain. It is then set on fire, and, burning away, it blisters the skin; and, although some persons may think it a coarse and rough method of treatment, it is generally a very successful one. *Polyporus suaveolens* has a smell like that of aniseed, and it is one of the few luxuries of Lapland. Linnæus says that the odour is there so much admired, that the young men carry it about them when they visit their mistresses, in order to render themselves more agreeable.

(669.) It is not unlikely that other species of Polypore may possess useful properties, or might be resorted to as the sources of valuable drugs. From *P. dryadeus* (the old *Boletus pseudo-ignarius*), Braconnet obtained his boletic, and from *P. squamosus* his fungic acid; and from *P. sulphureus* Dr. Scot, of Dublin, and Drs. Greville and Thompson, of Edinburgh, have procured oxalic acid and bin-oxalate of potash. Mr. Purton had previously noticed the pungent acid taste of this fungus, and especially of the porous part; and I once found an enormous mass of it, like that described by Dr. Greville, on an old willow-trunk in Kensington Gardens, which, while drying, became covered thickly, as if frosted over with a white salt, the bin-oxalate of potash, some of which, with part of the fungus, I now have by me.

(670.) *Polyporus lucidus* [§ 653,] is one of the most elegant species known. It is of so bright a colour, and so highly polished, that Mr. Curtis says, when he first discovered a magnificent specimen growing near Peckham, he scarcely knew whether he had found a natural or an artificial production.

(671.) *Polyporus squamosus*, already mentioned, [§ 666,) is one of the largest of the British fungi, equalling, and often exceeding in dimensions, the gigantic Bovista. Hopkirk has mentioned one, of which the growth was watched for six weeks, that attained an uncommon size. It measured seven feet five inches in circumference, and weighed thirty-four pounds, after it had been cut four days. It must therefore have gained nearly a pound and a quarter every twenty-four hours; and, if allowance be made for the four days' waste of substance, its increase must have been much more.

As these fungi are very common on the continent, they may probably be those to which reference is made with wonder by some of the older writers. Matthiolus mentions some extraordinary mushrooms, that weighed thirty pounds a-piece. Festus Imperatus declares that he had seen some that weighed upwards of one hundred pounds a-piece. But, to add no more, in the Journal des Sçavans there is an account placed on record of some growing on the frontiers of Hungary, which made a full cartload.

(672.) *Polyporus destructor* is one of the fungi included in the incongruous group commonly called dry-rots. Many of these agree in no other circumstance than that of their formidable power of destroying timber; and to wooden structures they are most fearful visitants.

(673.) *Merulidæ.* Similar names have not unfrequently been given to animals and plants, which make their appearance, or come to perfection, at the same season of the year. Thus, the appearance of the young fig and the cuckoo being synchronous in Greece, one and the same appellation (κοκκυξ) was given to both. In Turkey, *Bulbul* signifies both the rose and the nightingale; and *Merulius* and *Merula* are two scarcely differing terms, used, in like manner, by the Romans, to designate an eatable fungus and a blackbird, *i. e.* our *Morel* and *Merle.*

(674.) But, like many other ancient names, *Merulius* has long ceased to belong to the *Morel,* which by modern botanists is called *Morchella,* [§ 638;] and the present *Merulii* are the most formidable of the dry-rots; one species, more common and destructive than the rest, being termed emphatically THE *dry-rot.* *M. lachrymans,* the species referred to, is extremely variable in its appearance, often resembling a fine cottony Byssus. The fructification is rarely developed: when perfect, the sinuosities of the hymenium are not excelled in beauty by any work, either of art or nature. One of the finest specimens I have seen was discovered in the Duke of Norfolk's conservatory, and presented to the museum in King's College. Had it not been declared that the specific name *lachrymans* has reference to the drops of clear water with which the sinuosities of the hymenium are filled, it might have been supposed to be descriptive of the state of one whose property has been attacked by the Merulius.

(675.) *Dry-rot,* its causes, effects, and modes of prevention or cure, have long excited the attention not only of naturalists, but of the world at large. Indeed, the ravages which the *Merulii,* and other associated fungi, commit in ships, and every kind of wooden structure, as soon as a settlement is made, can be alone conceived by those who have witnessed and examined them. Without having seen vessels and houses in which these destroyers riot, no one can appreciate the ruin they entail. I knew a house into which the rot gained admittance, and which, during the time we rented it, (only four years,) had the parlours twice wainscotted, and a new flight of stairs; the dry-rot having rendered it unsafe to go from the groundfloor to the bedrooms. Every care was taken to remove the decayed timbers when the new work was done, yet the dry-rot so rapidly gained strength, that the house was ultimately pulled down. Some of my books which suffered least, and which I still retain, bear mournful impressions of its ruthless hand; others were so much affected, that the leaves resembled tinder, and, when the volumes were opened, fell out in dust or fragments.

(676.) Writers on naval architecture and on naval affairs record numerous instances of far more extensive and lamentable devastations. In the Quarterly

Reviews for 1812 and 1813 are some very able papers on this subject, from which the following cases are taken. The *Queen Charlotte*, a first-rate, which occupied seven years in building, was launched at Deptford in 1810, and sent round to Plymouth under jury-masts in 1811; and in 1812, when the account was written, she was found to be too rotten to be seaworthy, and was then undergoing a repair which, at the lowest computation, would cost 20,000*l*. Another ship, the *Rodney*, which was launched in 1809, had scarcely put to sea, when all her fastenings became loose, and she was obliged to be brought home from the Mediterranean in 1812, to be paid off. The *Dublin*, also, which was launched in February 1812, and put into commission the following August, affords another equally lamentable proof of the devastating effects of dry-rot. This ship was sent on a cruise towards Madeira in December of the same year, from which she returned to Plymouth, in 1813, in so dreadful a state that she was ordered to be paid off. Cases have been mentioned in which ships have rotted on the stocks, and been obliged to be repaired, even before they were launched; and in private dockyards numerous instances have occurred of vessels which had scarcely been at sea before they were knocked up, and sold for firewood: nor are such cases to be wondered at, when it is known that timber, while stacked for seasoning, which by the ordinary method requires four or five years, has gone to decay before it could be brought into use.

(677.) Some years ago, I examined this subject with considerable attention, and published the results of some experiments in Brande's Journal of Science. These researches led to the belief that rot and dry-rot, although very different, often owe their origin to nearly the same causes; *i.e.* that immature and ill-seasoned wood, and timber felled when the sap abounds, is the most liable to fall into ordinary decay; and that such timber is also most obnoxious to the attacks of those fungi which constitute dry-rot; the crude sap and half-elaborated contents of the ligneous cellules forming the very soil on which such parasites love to grow.

(678.) Seasoning is the means resorted to in order to convert the immature heartwood of trees felled too early, or the perishable sapwood into enduring timber. Barking the trees for a year or two before they are felled, is one plan that has been proposed; submerging the timber, or steeping it in various lyes, are other schemes; but the most common method is to stack the wood in such a manner that it may be freely exposed for four or five years to currents of air, while it is protected from the wet.

(679.) Lately another process has been introduced by Mr. Kyan. He steeps the timber in an aqueous solution of corrosive sublimate; and it is found that this salt, by entering into a chemical combination with the perishable juice of the plant, converts it into a substance upon which the dry-rot fungi cannot grow; and experiments have shewn that timber thus prepared has remained sound and unaffected under the most trying circumstances, in the fungus-pit in Woolwich dockyard, when pieces of similar timber, but unprepared, were speedily consumed.

The sublimate solution is found to be an equally effectual preservative to cords, cables, canvass, linen and cotton cloths, and other vegetable fabrics.

(680.) It had previously been observed that wooden vessels, in which metallic solutions of various kinds were kept, or which were used by the manufacturers of

metallic pigments, became almost imperishable; but Mr. Kyan was the first person who took advantage of this property, and rendered it economically important. It is the opinion of Professor Faraday, that the corrosive (or rather the anti-corrosive) sublimate forms so fixed and unchangeable a body with the vegetable matter, that it will not be washed out, or rise in vapour, so as to form an injurious atmosphere. He does not, however, say anything about the probability of this new combination becoming decomposed by the ordinary influences to which timber in ships, &c. is exposed; although he has proved that the mercury may be separated and reduced to its metallic state by means of nitric acid. Whether the bilge water and foul air in ships would not turn the linen and cotton cloths black, and the sulphuretted hydrogen, in such an atmosphere, reduce the quicksilver, are problems as yet unsolved. We know it to be the opinion of an eminent chemist that they would: and if so, as this gentleman says, in a note on Mr. Kyan's pamphlet, now before me, "its preserving efficacy and salubrity may be justly questioned." And when we consider that five or six thousand loads of timber are required for the construction of a first-rate vessel, it is of the utmost importance to determine whether such mercurialized ships might not, under certain circumstances, in a hot climate, become as unhealthy as the mines of Istria.

(681.) Several topics of inquiry here suggest themselves; for two of which even the commanding interest of the subject can but just claim mention. The first is, whether other less noxious metals may not prove equally efficient as preservatives of vegetable matter with the salts of quicksilver. Our friend already alluded to believes, from the casual observations of many years, that they would. And it might likewise be worth trying, whether some of the cheap essential oils would not be equally preservatives of large masses of vegetable matter from the attacks of the larger fungi which constitute dry-rot, as it is well known the odoriferous and more costly oils, and various other agreeable perfumes, are useful in exempting specimens in herbaria, and indeed almost everything else in the neighbourhood, from the attacks of the smaller fungi, which constitute mouldiness or mildew.

(682.) *Dædalea* (the *labyrinth*, or *maze-wort*), has received its name from the extraordinary sinuosities of its hymenium, which seem as if they could have been arranged by Dædalean art alone. The quercine species is the famed agaric of the oak: it is slightly styptic, and, when cut in slices, has been applied to wounds in order to restrain hemorrhage. When dried and powdered, it is sometimes taken in the form of an electuary in phthisis. It has by some persons been much commended: the dose is from a scruple to a drachm. Perhaps part of its reputation may be owing to its provincial name; for what can be so good in a consumption as "the lungs of an oak." It may be bought in Covent Garden; but must be asked for by its country title, as by that only is it known.

Dædalea suaveolens is fragrant, and is used by the young Lap-

landers as a perfume, on the same interesting occasions, and for the same purpose, as the *Polyporus suaveolens* [§ 668.] It also, as well as the *D. quercina*, is administered in pectoral complaints.

(683.) AGARICACEÆ. *Agaricus*, which gives name to this type and section, includes now more known species of fungi than any other genus. *Boletus*, however, seems to have been formerly the more comprehensive term, signifying almost any field mushroom or toadstool; while Agaricus was peculiarly applied to the Sarmatian fungi, which are said to have chiefly, if not exclusively, grown on trees. Thus, the ancient Boletus, ‘Fungorum princeps et dominus,’ is the present Agaricus cæsareus, and the Dædalea quercina is still called the agaric of the oak. Hence, although Agaricus gives its name to the section, Boletus, as of right, denominates the order.

(684.) *Agaricus* (the mushroom or toadstool), and *Cantharellus* (the chantarelle), are the two best known genera in the type. Cantharellus, and its immediate allies, in which the lamellæ or plates of the hymenium are often cleft and irregular, and occasionally anastamosing and contorted, may be considered as transitions from the sinuous *Boletidæ* to the great group of Agarici, in which the lamellæ are entire. Were these two series to be esteemed subtypes, further and more important distinctive characters might be given; for, while in the *Cantharellidæ* the lamellæ are concrete, with a mostly coriaceous pileus, in the *Agaricidæ* the lamellæ are subdiscrete, and the pileus fleshy.

(685.) The Agaricaceæ are distinguished from the only two other types in this section, by having their hymenia lamellate or plaited; for, in the *Boletaceæ* the hymenia are sinuate, porous, or subulate, and in the *Auriculariaceæ* tuberculate, papillose, or smooth.

(686.) *Favolus* (the honey-comb fungus), placed by Fries in the first division of the *Agaricaceæ*, has usually been arranged as an associate of the Polypores; indeed, as one of the subgenera of *Polyporus: Cantharellus* was also once considered a *Merulius*. These therefore, with their allies, *Xerotes* and *Schizophyllum*, which is acknowledged to be aberrant, establish here, as elsewhere, the connexion of the types, notwithstanding their characteristic differences, which are only progressive gradations of structure.

(687.) One species of the Chantarelle, the C. aurantiacus, is said to be delete-

rious; another, the C. cibarius, is much esteemed on the continent as food, and in some parts the people are reported to subsist almost entirely upon it: hence its name *Escraville*, a corruption of *Esca villæ* (village food.) It is occasionally used in the south of England, but never in the north; where, however, according to Johnston, it is by no means common. Chantarelles, the yellow fungi, or Pixy stools, of our provinces, are rather tough, and seem to be better fitted for flavouring sauces than to be eaten alone. They are scentless when quite fresh, but, shortly after being gathered, they exhale a pleasant odour, like that of ripe apricots; and, when they have become flaccid, they are usually strung in rows, and hung in an airy place to dry. Thus preserved, they are ready for use at any time, and form a delicious ingredient in rich gravies, &c.

(688.) The Chantarelle was so called by the French, from a fancied resemblance the eatable species bears to the head and open beak of a cock in the act of crowing; and, as Greville says, to the same cause may be traced the still older name of Gallinaceus. Indeed, few fungi possess so many synonymes; their bare enumeration nearly fills a closely printed page in the Cryptogamic Flora. Like various other mushrooms, it is injurious if eaten raw, but becomes harmless by drying, or by exposure to heat.

Mushrooms of all kinds, and especially the *Boletaceæ* and *Agaricaceæ*, should be gathered for the table before their full development, as many then become tough, others insipid, and some, which are wholesome when young, are deleterious at a later age. Experience has shewn that in such cases, as well as in fungi commonly reputed hurtful, it often happens that the hymenium alone is noxious, while the rest of the plant is unexceptionable. The hymenium should therefore invariably be removed when it is tubular, and even in the agarics when they are old. Specimens beginning to decay, as well as those which have been partly consumed by vermin, should also be rejected.

(689.) The genus Agaricus is believed to contain upwards of a thousand different species. Sprengel enumerates only 646, but this is much below the number described by other authors. So immense a group imperatively requires subdivison; but, although numerous attempts have been made, so similar are they to each other in the more essential characters, although an infinite diversity is evident in minor points, that it has been found impracticable to do more than distribute them into subgenera; no differences having as yet been found of sufficient importance to be made generic signs.

"Facies non omnibus una,
Nec diversa tamen, qualem decet esse sororum."

(690.) The subdivisions of the genus proposed by Fries amount to eight, which eight groups are again distributed into thirty-three subgenera, all of which are distinguished by structural peculiarities; so that the labour of examination is very much diminished, and comparisons may now be made in these with as much facility as in other groups of plants. It would be a pleasing task to trace the steps by which this more than Briarean genus, that stretches its species by hundreds on every side, has been reduced by botanic skill to the simplest state. But, however fitted for a *Species* or *Genera* Plantarum, this digression would be foreign to a work which professes to treat only in outline of the natural history of vegetables, and to illustrate, by reference to the most important examples, the types and sec-

tions of the natural orders. A tabular conspectus of the plan is therefore all that can be admitted here.

AGARICUS. *Lamellæ simple, unequal, juiceless, persistent, discrete from the pileus.*	LEUCOSPORUS. *Lamellæ unchangeable, veil variable or none, sporidia white.*	Amanita Lepiota Limacium Tricholoma Clitocybe Omphalia Collybia Mycena Omphalia Pleurotus
	HYPORHODIUS. *Lamellæ changeable in hue, veil none, sporidia rose-coloured.*	Clitopilus Eccilia Leptonia Nolanea.
	CORTINARIUS. *Lamellæ changeable, veil like a cobweb, sporidia ochraceous.*	Telamonia Phlegmacium Inoloba Dermocybe.
	INOCYBE. *Lamellæ changeable, veil springing longitudinally from the innate fibres of the pileus, sporidia tawny brown.*	Inocybe.
	DERMINUS. *Lamellæ discoloured, veil floccose, sporidia subferruginous.*	Pholiota Hebeloma Flammula Naucoria Galera Tapinia Crepidotus.
	PHŒOTUS. *Lamellæ changeable, nebulous, veil various, sporidia dark brown.*	Pratellarius.
	PRATELLUS. *Lamellæ changeable, lax, nebulous; veil floccose; sporidia brownish purple.*	Volvaria Psalliota Gomphus Hypholoma Psilocybe Psathyra.
	COPRINARIUS. *Veil partial; lamellæ lax, nebulous; sporidia black.*	Coprinarius.

(691.) *Coprinus* (the dung-stool), is a genus separated from Agaricus, and intermediate between it and Cantharellus. Some of the species are European; but they are of too soft a texture, and nauseous a taste, to be eatable: *C. cinereus* is so rapid in its growth and decay, that it attains perfection, and dissolves away, in the course of a few hours. In the Spice Islands, however, there are two species, one of which (*C. saguarius*) inhabits the pith of the sago-palm, and the other (*C. moschocaryanus*) a parasite on the nutmegs, that are said to be delicious.

(692.) *Russula* (the mush-russet), and *Galarheus* (the milk-stool), are names which have been given to two groups of fungi formerly considered agarics, and still by some persons esteemed subgenera of that immense association: by Fries, however, they are accounted generically distinct. The *Galarhei*, which have been so named from the lactescence of many species, are some of them deleterious, and others esculent. *Agaricus* (Galarheus) *necator* and *thejogalus*, which have a yellowish juice, are deadly poisons; *A. vietus*, *acris*, *blennius*, and *pyrogalus*, are very acrid; *A. helvus* and *aurantiacus* rather less so, but still hurtful; *A. controversus* and *torminosus* must be considered dangerous, notwithstanding Persoon says the former is eatable, and Buxbaum states that, in times of scarcity, the latter is eaten by the Russians, mixed with salt, vinegar, and oil; *A. subdulcis* is said to be occasionally fed on, and *A. piperatus*, when dressed, to lose its bad taste, and to be esteemed as food in Alsace: *A. deliciosus* is considered a delicacy everywhere. Climate seems to affect this species less than most others. When well dressed, it is described to be "very luscious eating, full of rich gravy, with a little flavour of muscles." When Sir J. E. Smith visited Marseilles, he says "the market exhibited a profusion of spring-flowers, and even carnations, intermixed with grapes, dates, pomegranates, and a prodigious quantity of Agaricus deliciosus, which really deserves its name, being the most delicious mushroom known; though it must be confessed that nothing can be less attractive than its appearance, its colour being a dirty brown, and the juice of a deep orange, soon turning to a livid green, wherever the fungus is touched or bruised."

This subgenus contains fungi both esculent and poisonous, and almost in every grade: it is therefore a very suspicious group; probably the same noxious principle is present in all, though developed in different degrees. It is a curious circumstance, but one which meets with many parallels, that most of the poisonous mushrooms, and particularly those just mentioned, are the favourite food of goats during the rutting season: whether these animals can eat them at other times with impunity, is not known. The juice of the *A. piperatus*, mixed with syrup of marshmallows, is stated by Losel, in his "Flora Prussica," to be a powerful diuretic.

(693.) The *Russulæ* are fungi which owe their subgeneric name to their generally russet hue. Some of them are eatable, as *R.*

alutaceus; while others, as *R. ruber*, *nitidus*, and *emeticus*, are so nauseous, bitter, and acrid, as to be wholly unfit for food.

(694.) [*Coprinarius.*] *Coprinarius*, the first subgenus of the Agarici, contains various fungi that luxuriate on dunghills. None of them are known to be poisonous; neither are any esteemed as food.

(695.) [*Pratelli.*] The subgenus called *Psalliota* contains the common mushroom [§ 600, fig. E, G,] *Agaricus* or *Psalliota campestris*, with several other species that are mostly eatable. The mushroom is indigenous to the whole of Europe, reaching even as far north as Lapland; it is likewise found as far south as Japan in Asia, and in the northern parts of Africa and America. The *Agaricus Georgii*, which by some is considered only a variety of the foregoing, is a larger mushroom, but its flavour is less delicate. When cultivated, it often attains an immense size. Dr. Withering mentions one gathered from a hotbed near Birmingham that weighed fourteen pounds.

Even these mushrooms, which of all are the least suspected of containing any deleterious principles, are occasionally found to be injurious. Most of the cases of poisoning by mushrooms are, however, owing to other species being gathered by mistake; quantity, rather than quality, seeming to be the object of those who collect them. Dr. Christison says, "I have seen those who gather mushrooms near Edinburgh, for the purpose of making ketchup, picking up every fungus that came in their way." Fatal accidents from such carelessness or ignorance would doubtless be much more frequent than they are, if the poisonous properties of many fungi were not dissipated by heat; and the spices with which they are mixed in cookery are the best antidotes that could be administered to counteract their injurious effects.

(696.) [*Dermini.*] The *Agaricus translucens* (in Fries, subgenus *Crepidotus*), is said by De Candolle to be eaten by the poor people of Montpelier: it is, however, a watery mushroom, and must form very indifferent food. *Agaricus (Crepidotus) olearius*, which grows on the olive-trees of the south of Europe, is poisonous. It is remarkable for being phosphorescent, and exhibiting a luminous appearance at night.

(697.) [*Inocybe.*] The subgenus Inocybe is a solitary one, like Coprinarius and Phæotus. It contains several fungi differing considerably from the other groups by their fibrous veils. Their nauseous odour renders them unfit for food; but, although suspected, they are not known to have deleterious properties.

(698.) [*Cortinarii.*] Agaricus (or Dermocybe) cinnamomeus, is another eatable species. Those fungi which, from their gigantic stature, have received the figurative subgeneric name *Telamonia*, are none of them eaten; but *Agaricus* (or *Inoloma*) *violaceus* is much esteemed. When well broiled and duly seasoned, it is said to be as delicious as an oyster. It is not uncommon in the woods near Bath and Worcester, during the latter part of the autumn; and is sometimes sold in Covent Garden under the name of Blewits.

(699.) [*Hyporhodii.*] *Nolanea* (the bell-stool), *Leptonia* (the slight-stool), and the other subgenera included amongst the *Hyporhodii*, are inodorous, insipid, innoxious plants, but watery and unfit for food.

(700.) [*Leucosporii.*] The subgenus *Pleurotus* contains a group of innoxious fungi, several of which are esculent; as *A. ostreatus*, *ulmarius*, &c., some of these attain a prodigious size; but they are rarely used in England. Sowerby mentions having seen the latter species two, or even three, feet in circumference, so that, had not prejudice forbidden, half-a-dozen men or more might have made a hearty and a wholesome meal from a single mushroom.

(701.) *Agaricus* (or *Collybia*) *esculentus*, *A.* (or *Clitocybe*) *fusipes*, *nebularis*, *virgineus*, *odorus*, *pratensis*, and *oreades*, are all eatable species, and more or less esteemed by different persons. The last named are called *Scotch-bonnets* in the north. C. pratensis is often collected in the western counties, and called champignon; C. odorus has a peculiarly pleasant smell, like woodrough, or new-mown hay, and hence it probably contains benzoic acid.

Several Agarics, amongst which are two species of this subgenus, viz. *C. oreades* and *giganteus*, affect a peculiar mode of growth, always being found in circles, the diameters of which are, however, very various: Major Velley mentions having seen some formed by A. terreus, from ten to fifteen yards across. "These *fairy rings*, so common on our grassy links and old pastures, where

of old the merry elves were seen,
Pacing with printless feet the dewy green;"

were, when this land was "fulfilled of faerie," believed to be the result of their midnight reels, and hence they have been called fairy rings, as the Chanterelles, on which the *Pixies* were supposed to rest, received the name of Picksey-stools. But now, as Johnston says, when no man can 'see no elves mo,' another explanation of the phenomenon has become necessary. Several have been offered, but only two that possess much semblance of truth. The first of these considers them the results of electrical discharges. Dr. Darwin states this argument with his usual ingenuity. He says, moist trees are the most common conductors of the numerous flashes of lightning which pass from the clouds to the earth, and much timber is thereby cracked and injured, but frequently large prominences of

the clouds, gradually sinking, their electricity is discharged on knolls, or the moister parts of grassy plains. Now a corner of a cloud thus attracted by the earth becomes nearly cylindrical, as loose wool does when drawn out into a thread, and it will strike the earth with a stream of electricity perhaps two, or perhaps ten, yards in diameter. As a stream of electricity displaces the air it passes through, it is plain no part of the grass can be burned by it, but just the external ring of the cylinder where the grass can have access to the air, since without air nothing can be calcined. The earth, after having been thus calcined, becomes a richer soil, and either fungi, or a bluer and richer herbage, will, for many years, mark the place. There are many circles of several yards in diameter near Foremark, in Derbyshire, which annually produce large white fungi and stronger grass, and have done so, it is said, for upwards of thirty years.

Electrical discharges may be one cause of the production of fairy rings; but that they are not the only cause seems probable, from the fact that never more than one species of mushroom has been detected in the same ring, which circumstance has been deemed conclusive by many that fairy rings owe their existence to Agarics. This belief led Dr. Withering to seek another cause; and he has offered the following explanation. A tuft of Agarics spring up, which, exhausting the soil on which they grow, the succeeding crop would necessarily form a circle round the central spot from which the primary tuft had withdrawn its nutriment. The first circle being thus produced, circles successively larger and larger would annually be formed, until at length they were interrupted by accident, or lost by their extent. For fungi, like other plants, seem to exhaust the soil of some peculiar nourishment fitted for *their* growth, although sufficient food may be left for the support of other plants; this being merely an example of the natural rotation of crops, which, since it has been observed and adopted by farmers, has proved so great a benefit. A luxuriant growth of grass would follow the decay of each agaric ring as the natural consequence of the circle being enriched by the rotting fungi; new crops of which, of course, would travel outwards, stretching into the unexhausted soil. Subsequent observation appears to confirm this view; nor is it weakened by the observation of Major Velley, who states, that if a cluster of the Ag. terreus be destroyed, another will in a short time spring up on the *same* spot, and if that be crushed, it will be succeeded by a third. These facts only prove that the first and second were destroyed *before* they had exhausted the soil, which hence was able to support another generation.

And thus hath philosophy withdrawn their occupation from all those

—— "demi-puppets that
By moonshine did the green sour ringlets make
Whereof the ewe not bites; and those whose pastime
Was to make the midnight mushrooms."

(702.) Several of the species of the subgenus *Tricholoma* are eatable, but one only, the *T. Russula*, is much esteemed. Of the *Limacia* several are noxious; but one species, *L. eburneum*, is eaten in Italy under the name of *Mugnaio*. The *Lepiotæ*, or scaly mushrooms, are some of them fœtid and unfit for food, and others are insipid and worthless: two or three species, however, are frequently eaten even in this country, where fewer fungi are admitted to the table than in almost any other. *Agaricus* (*Lepiota*) *excoriatus* and *procerus*, are both edible; the latter sometimes makes its appearance in Covent Garden market; and throughout the whole of France and Italy it is an ordinary article of diet: it has various foreign names, amongst which the more common are *Mort de froid*, *Mazza di tamburo*, and *Nez de chat*.

(703.) The *Amanitæ* afford examples of some of the most splendid fungi known. To use the language of our neighbours, *A. imperialis* is magnificent, but *A. cæsarea* is superb. The latter is the plant, already mentioned, as having been styled by the ancients *Fungorum princeps* et *Dominus;* and none could better deserve the name.

Withering believed the *A. cæsarea* and *xerampelina* to be one, or merely varieties, of the same species. From this opinion, however, Dr. Greville dissents. From a mere verbal description of this Agaric, it is evident that its appearance must be rich in the extreme. The stipes is columnar, slightly tapering upwards, about five inches high and half an inch in diameter, of a rich buff colour shaded with red; the pileus is about twelve inches round, convex, and bossed in the centre, with the circumference bent down. The upper surface is at first of a beautiful carmine, which changes after a time to a rich orange, and ultimately becomes buff; the hymenium is of a bright golden yellow, tending to orange at the extremities of the gills, where they meet the red tunic of the pileus.

(704.) The A. cæsarea is a fungus possessed of some classic fame; it has been celebrated both by Juvenal and Martial; not so much, however, for its beauty, as for the traditional belief that it was in a dish of these mushrooms, which by the ancient Romans were considered the greatest luxuries of the table, that Agrippina administered poison to her husband, Claudius Cæsar, to hasten her son's accession to the throne. Hence probably it derived its specific name *Cæsarea*; but Nero, for whose sake Claudius had been poisoned, called it the *food for gods,* because, after his death, Claudius was numbered amongst the Roman deities.

(705.) It appears, from Pliny, that, after the murder of Claudius, mushrooms fell into unmerited disrepute. He says, "Among all those things which are eaten with danger, I take it that mushrooms may be justly ranged in the first and principal place: true it is they have a most pleasant and delicate taste; but discredited much they are, and brought into an ill name, by occasion of the poison which Agrippina, the empress, conveyed unto her husband the emperor by their means: a dangerous precedent given for the like practice afterwards." (*Holland's Trans.*) The A. cæsarea has, however, through the lapse of time, again recovered its reputation, for now it is commonly seen in the Italian markets; in Italy it is abundant, but in these kingdoms rare. It is liable to be mistaken for a poisonous species belonging to the same subgenus, but may easily be distinguished by its yellow gills from the A. imperialis, in which they are always white.

(706.) *Amanita nivalis,* which Dr. Greville says is the most alpine fungus he is acquainted with, and which grows on the bleak summits of the Grampians, enlivening by its symmetry and extreme whiteness the few turfy spots that occur in those desert regions, is found also in Italy, according to De Candolle, who quotes from Michelli, and says that it is eaten by the Tuscans, and by them called *Fungo marzuolo,* or *dormiente. Amanita ovöidea* is also said to be delicious; and A. vaginata is fed upon by the poor in Muscovy: but cases are on record in which it has proved poisonous.

(707.) The *Amanita imperialis* [§ 600, fig. A, B], has long been notorious for its intoxicating and poisonous properties. It has sometimes been eaten by mis-

take, and the results have proved fatal. Linnæus tell us that in Denmark the natives cut it in pieces, which they steep in milk, and it then proves as destructive to flies as arsenic; hence it has received its present specific name, *Muscaria*. Dr. Johnston corroborates this fact, by stating that he has observed flies which sip the dirty yellow liquor into which the Amanita dissolves die almost immediately. Haller mentions the cases of six Lithuanians, who perished at one time by eating this Amanita. And Christison, among other instances, relates those of four French soldiers, who were killed, and others who were much disordered, by a similar fatal repast. Orfila likewise records similar examples of its virulence, in one of which a whole family was poisoned and, although some were recovered by speedy remedies, two died. The Amanita is nevertheless employed by the Ostiacks of Siberia, the Kamtschatdales, and Koriacks, for the purpose of producing intoxication. These infatuated people "sometimes eat it dry, sometimes immersed in a fermented liquor made with the epilobium, which they drink, notwithstanding the dreadful effects that inevitably follow. At first they are seized with convulsions in all their limbs, then with a raving, such as attends a burning fever; a thousand phantoms, gay or gloomy, according to their constitutions, present themselves to their imaginations; some dance, others are seized with unspeakable horrors. They personify this mushroom; and if its effects urge them to suicide, or any dreadful crime, they say they obey its commands. To fit themselves for premeditated assassinations, they take the *Mouchomore*, the Russian name of this Agaric; and, such is the fascination of drunkenness in this country, that nothing can induce the natives to forbear this dreadful poison." (*Pennant.*)

(708.) The most complete and satisfactory account of this fungus, and its extraordinary effects, which has yet been published, will be found in a German essay, by Dr. Langsdorf, in *Annalen der Wetterauischen Gesellsrchaft für die gesammte Naturkunde*. This essay has been quoted by Dr. Greville, in his treatise on the esculent Fungi of Great Britain, and from his translation the following are extracts.

"The variety of *Amanita muscaria*, called *Kamtschatica*, is used by the inhabitants of the north-eastern parts of Asia in the same manner as wine, brandy, arrack, opium, &c. are by other nations. These fungi are found most plentifully about Wischna, Kamtschatka, and Mitkowe Derewna, and are very abundant in some seasons, and scarce in others. They are collected in the hottest months, and hung up by a string in the air to dry; some dry of themselves on the ground, and are said to be far more narcotic than those artificially preserved. Small deep-coloured specimens, thickly covered with warts, are also said to be more powerful than those of a larger size and paler colour. The usual mode of taking the fungus, is to roll it up like a bolus, and swallow it without chewing, which the Kamtschatdales say would disorder the stomach. It is sometimes eaten fresh in soups and sauces, and then loses much of its intoxicating property; when steeped in the juice of the berries of *Vaccinium uliginosum*, its effects are similar to those of strong wine.

"One large, or two small fungi, is a common dose to produce a pleasant intoxication for a whole day, particularly if water be drank after it, which augments the narcotic effect. The desired effect comes on from one to two hours after taking the fungus, in the same manner as from wine or spirits: cheerful emotions of the mind are first produced; the countenance becomes flushed; involuntary words

and actions follow, and sometimes, at last, an entire loss of consciousness. It renders some remarkably active, and proves highly stimulant to muscular exertion: with too large a dose, violent spasmodic actions are produced.

"So very exciting to the nervous system, in many individuals, is this fungus, that the effects are often extremely ludicrous. If a person, under its influence, wishes to step over a straw or a small stick, he takes a stride or a jump sufficient to clear the trunk of a tree; a talkative person cannot keep silence or secrets; and one fond of music is perpetually singing.

"The most singular effect of the *Amanita*, is the influence it possesses over the urine. It is said that, from time immemorial, the inhabitants have known that the fungus imparts an intoxicating quality to that secretion, which continues for a considerable time after taking it. For instance, a man moderately intoxicated to-day, will by the next morning have slept himself sober; but (as is the custom) by taking a teacup of his urine, he becomes more powerfully intoxicated than he was the preceding day by the direct administration of the fungus. This intoxicating property of the urine is capable of being propagated; for every one who partakes of it has his urine similarly affected. Thus, with a very few *Amanitæ*, a party of drunkards may keep up their debauch for a week. Dr. Langsdorf mentions, that by means of a second person taking the urine of the first, a third of the second, and so on, the intoxication may be propagated through five individuals."

(709.) Like many other poisonous plants, this fungus, which possesses such extraordinary powers, might, if judiciously administered, become a serviceable medicine. Less attention has been paid to it than it deserves. It has, however, been exhibited in epilepsy and palsy, and, it is said, with satisfactory results.

(710.) The *Amanites* form the last of the numerous subgenera that the genus *Agaricus* includes, and with the foregoing accounts of the *Agarici*, the illustrations of the type *Agaricaceæ* is closed. The *Agaricaceæ* terminate the section *Agaricinæ*, which is the final one in the order Boletales; and the order *Boletales* being thus concluded, the illustrations of the class are at an end. It therefore only now remains to give the usual tabular conspectus of the distribution of the order last examined, with references to those sections, in which definitions will be found of the several groups.

Order.	Sections.	Types.
BOLETALES, or MYCETALES.	Agaricinæ (642)	*Agaricaceæ* (682) *Boletaceæ* (648) *Auriculariaceæ* (644)
	Helvellinæ (639)	*Helvellaceæ* (634) *Pezizaceæ* (628) *Clavariaceæ* (617)
	Tremellinæ (612)	*Cyphellaceæ* (611) *Exidiaceæ* (609) *Tremellaceæ* (608).

(711.) Botanical characters, which in general indicate the properties of plants by shewing the affinities of unknown species with those the qualities of which are known, have long been considered to fail in their application to the fungi: and this group has often been cited as a reproach to the natural system of arrangement. But the previous demonstrations will have shewn that the reproach has been, if not unmerited, at least premature; for the fungi, instead of forming but *one* group or natural family, as they were esteemed by Ray, Linnæus, Jussieu, and even by many living writers, are shewn to include many types and sections, equivalent to the groups, called natural families and orders by different botanists, and to form collectively a group, not analogous to the subordinate families or orders *Rosaceæ*, *Solaneæ*, &c., but a class equal in rank either to the glumaceous, or petaloïd monocotyledons; the gymnospermous or angiospermous Exogenæ; *i. e.* to the Segetes or Palmares; the Zapini, Eucarpæ, or Selanthi. Such being the case, it will be evident that, although the fungi are some of them highly acrid and venomous, others esculent, and others inert, these differences are no greater than what occur in most other classes of equal rank and magnitude; the homogeneity which attends homomorphism, *i. e.* the similarity of quality which in general is associated with similarity of form, in the majority of cases not extending to larger groups than are here called types and sections, by whatever variety of names they may be distinguished by various authors.

(712.) Many errors seem to have been adopted with regard to the pretensions and objects of the so-called natural scheme; one more of which needs, here, correction. The natural synthesis does not pretend always to associate plants of similar qualities and properties; but, as far as knowledge permits, to associate those which are structurally allied. In thus doing, it is found that certain groups, having similar forms, have similar qualities; *i. e.* are both homomorphous and homogeneous; while those which are essentially unlike in structure, are unlike in properties also; *i. e.* being heteromorphous, they are in general heterogeneous.

(713.) This doctrine, of the analogy existing between internal properties and external forms, is one of the most valuable in the science, but it has been frequently abused; less, however, by its opponents than its supporters, who have often injudiciously endea-

voured to convert a general into a universal rule, when both experience and experiments shew that some plants, naturally associated by structure, possess very diverse properties, some differing in degree, and others essentially in kind. Still the natural system is not the less useful when it points out the suspicious groups, than when it indicates those which are uniformly poisonous or wholesome.*

(714.) But the fungi have often been said to deviate more from this analogy than most other plants; and the statement in some measure is correct, yet it requires considerable qualification; for, while some groups are invariably sane, and others noxious, others again have their qualities affected by soil and climate to an extent which, if not wholly without a parallel, is comparatively rare among other plants.

(715.) These apparent anomalies, occurring in several of the most common and familiar species, have led some persons to believe the fungi, in general, to be irreducible to those laws which prevail in other natural groups of plants. And this error was fostered, if not engendered, by the former association of all the fungi in a single natural order, *i. e.* the confusion of many typical groups in one; and which, as they were dissimilar in structure, must necessarily exhibit dissimilar properties also.

(716.) The extent of this confusion will best be seen, by reducing the sections and orders into which the class is now distributed to a tabular form, similar to those conspective tables which have already been given at the conclusion of each order. It should, however, be remembered, that each of the sections contains several *types* which are equivalent to those groups, which are called *orders* by some botanists, and families by others, but which are of equal rank and importance, by whatever names they are known.

* Besides the systematic characters by which the wholesome and hurtful agarics may be distinguished from each other, experience has led to, and experiments have confirmed, the following more popular generalizations. A pure yellow or golden colour denotes a good quality. Many excellent species have a very pale or nearly white pileus, and some are brown. Those with vinous red or violet caps are universally wholesome. But the orange red and rose coloured ones are poisonous. Those which are green, or black, or purple changing to black, are also hurtful. Like the Boleti, those agarics which have unilateral pilei are mostly noxious, as well as those in which either the receptacle of the cap is very thin in proportion to the gills; or in which the lamellæ are all equal in length; or in which the collar is of a thin membrane, like a spider's web. Lactescent and deliquescent agarics, and also such as grow in tufts on trees, are in general to be avoided.

Class.	Orders.	Sections.
	Boletales	*Agaricinæ*
		Helvellinæ
		Tremellinæ
FUNGI	Tuberales	*Tuberinæ*
		Bovistinæ
		Sphærinæ
	Mucedinales	*Tubercularinæ*
		Mucorinæ
		Uredinæ.

(717.) The inevitable tendency of confounding so many groups, which are naturally distinct, was to render the fungi apparently much more anomalous than they really are; and now that the distribution of the class has been improved, many of the supposed deviations have been cancelled, and those which remain are but the exceptions to the rule, as are several which occur in other classes. Thus, the *Tuberaceæ*, the *Clavariaceæ*, and the *Helvellaceæ*, are as homogeneous as the *Malvaceæ*, the *Cruciferæ*, and *Solaneæ;* and the *Boletaceæ* and *Agaricaceæ*, the most abnormal of the whole, are not more so than the *Papilionaceæ*, the *Umbelliferæ*, and *Urticeæ*.

(718.) The malign influence of this error has been no where more sensibly felt than in Britain; for, the fungi being condemned in the gross as deleterious plants, very few have been able to withstand the prejudice raised. Thus, at least, thirty of our indigenous species are esculent, but not more than two or three are eaten; and our paupers starve with food around them which in some continental states is esteemed a luxury, and in others, forms a staple article of diet.

(719.) Greville, upwards of ten years ago, directed public attention to this subject, in a very able memoir, read before the Wernerian Society of Edinburgh; but still "the Fungi are looked down upon with contempt and aversion;" and Great Britain, possessing most of those species that supply a constant resource to thousands on the continent, continues to be the only country in Europe in which they are wasted and despised. In Russia, and throughout the greater part of Europe, the fungi form "a regular article of diet, and not merely as a resource in times of scarcity, but as a delicacy. It is therefore not a little extraordinary, that *we*, who have before our eyes several esteemed species in profusion, should neglect the whole, except the common mushroom, the Truffle, and the Morelle. On the continent it is a common practice to eat various fungi in a raw state, which, it is said, renders them more nutritious. SCHWÆGRICHEN mentions this expressly in a letter quoted by Persoon: "In travelling through Germany and Austria, I observed the peasants in the vicinity of Nuremberg, where I lived part of the summer, to eat raw mushrooms seasoned with anise and carraway seeds along with their black bread. Being then employed on the study of cryptogamous plants, I resolved to try the effect of this kind of food on my own person. I therefore

imitated these people, and succeeded so completely, that during several weeks I ate nothing but bread and raw fungi, and drank nothing but water. Instead of finding my health affected, I rather experienced an increase of strength. I preferred those species which had neither a bad flavor nor a disagreeable smell, and which had a tolerably firm consistence; as *Boletus esculentus, B. rufus, Agaricus campestris, A. procerus, Clavaria corallöides,* &c.

"I have observed that fungi, if moderately used, are very nourishing, but that they lose their good qualities by culinary preparation, which deprives them of their natural taste." (PERSOON *Traité sur les Champignons comestibles.* GREVILLE, &c.)

(720.) The opinion of Schwægrichen as regards the effects of cooking, upon fungi, is not consonant with general experience. It is true that many of the innoxious fungi have their flavour impaired by long exposure to heat; and it is probable that they may thus be rendered less nutritious, yet it is also well known that various mushrooms are not only improved by cookery, but that several which are poisonous in a raw state, are innoxious after they are dressed.

(721.) The analyses of fungi which have been made by Braconnot and Letellier are also favorable to their culinary preparation; for, besides the *fungin,* as the bulk of the materials which compose the plants is called, and which appears to be harmless both in the poisonous and wholesome species, these chemists found in some albumen and adipocire, in others saccharine matter, in some peculiar acids, as the *fungic* and *boletic,* in others an acrid resin, and in others an acrid and volatile principle. M. Letellier also discovered in some fungi one, and in others two, peculiar poisonous principles. One of these principles is an acrid matter so very fugacious, that it disappears when the plant is either dried or boiled, or macerated in weak acids, alkalies, or alcohol. To this principle, he says, the irritating properties of some of the fungi are owing. The other principle is more fixed, as it resists drying, boiling, and the action of weak alkalies and acids. It is soluble in water, has neither taste nor smell, and forms crystallizable salts with acids. To this principle he attributes the narcotic properties of some fungi. He has found it in the *Amanita muscaria, verna,* and *bulbosa,* and therefore proposes to call it *Amanitine.* Its effects on animals appear to resemble considerably those of opium." (*Arch. Gen. de Med.* xi. 94, *and Christison on Poisons,* 772.)

(722.) The result of these experiments will satisfactorily account for the beneficial effect of heat on some poisonous fungi, and its inefficiency with others; for, those which are rendered deleterious by the presence of the volatile poison only, would, of course, be converted into wholesome food by cookery; while those, in which both are present, or such as the Amanitæ, in which the latter abounds, would still be noxious, notwithstanding their exposure to heat.

(723.) These various principles, which seem to be analogous to those proximate principles upon which the peculiar properties of other plants depend, are not all present in all fungi, but, being variously distributed, and in different degrees developed, confer, with other principles, many of which, as the oxalic acid, &c., have been detected, their peculiar and characteristic qualities upon the numerous genera and species of this very extensive class.

(724.) Fungin, which forms the bulk of all the fungi, is in itself innoxious, and it is a highly nutritious substance; it contains nitrogen, and is very similar in its composition to animal matter. Indeed, so similar as to lead flesh-flies, by an error of instinct, to deposit their eggs in many toadstools. This, in different mushrooms, is of different degrees of density, according to the quantity of water it is joined

with, and acquires different odours, flavours, and properties, according as other principles are added, and according to the degree in which they are evolved.

(725.) In certain situations, truffles, morels, and common mushrooms, are nearly tasteless, while in others, their grateful tastes and smells are highly developed; and in a similar way, certain fungi, which are eatable in one country, or when gathered from one situation, are deleterious when growing in another. This difference depending upon the greater or less quantity of the poisonous matter formed, the production of which may be favored or suppressed by external physical circumstances, just in the same way as celery is said to be poisonous, and sea-kale and asparagus not eatable, when growing wild, but which become bland and esculent when chance or culture, by excluding light, prevents the formation of their acrid principles.

(726.) Before any rational account could be given of these changes, many curious speculations were indulged in, which rather excited than satisfied the curiosity of the ignorant. Fungi, as well as other plants, were formerly believed to be poisoned by the breath of toads and snakes. Pliny gravely asserts that they are very fit objects to retain the venom conveyed by the breath of serpents; and it is thought that the vulgar name, toadstool, which is given to many poisonous mushrooms, has reference to such a belief. Boccaccio furnishes an illustration of the prevalence of the idea; for, in one of his tales, he attributes the death of two lovers to their having put into their mouths sage-leaves plucked from a plant under which there was subsequently discovered a huge toad, whose venomous breath had rendered the sage-leaves poisonous.

(727.) Richard was so convinced of the influence of soil and climate upon fungi, that he would never eat any even of the common mushrooms which had not been cultivated. This, however, was an over-jealous care; for, notwithstanding there have been some few reports of eatable mushrooms proving injurious, they are not more than may fairly be attributed to idiosyncrasy.

(728.) When deleterious fungi have been eaten, the symptoms they produce are in a great measure similar to those which follow the exhibition of other acrid-narcotic poisons: usually the effects are compound, but occasionally, according to the fungus taken, or the state in which it has been eaten, the symptoms are more or less purely those of acrid or of narcotic poisons.

(729.) The spices and the spirit with which fungi are served up to table on the continent are believed often to destroy or neutralize their deleterious powers; and hence their administration has been recommended when poisoning from mushrooms occurs. No especial antidote is known; but, after the offending matter has been dislodged, ammonia and other stimulants may be given, if the narcotism prevails; and bland drinks, with other antiphlogistic remedies, if the irritation predominates, which it often does to a fatal extent.

GEOGRAPHICAL DISTRIBUTION OF THE FUNGI.

(730.) Plants so essentially nomadic as the fungi, plants so peculiarly privileged to wander from place to place, whose general usefulness depends upon their vagrancy, and whose chief importance results from their intermittent and remittent visitations; at one time being present in the utmost profusion in a place where for years or for ever, they had not occurred, and may not occur again; can

scarcely be expected to afford many fixed data as to their topographical localities, or to require much to be said of their geographical distribution.

(731.) Still, meagre as are the materials as yet collected that are available for this department of the study, there are evident indications that, if our knowledge were as extended as the facts are cognizable, the habitats and stations of the fungi would be found to be as relatively definite as are the geographical and topographical ranges of other and higher plants. For parasitic fungi, and even those which are parasitic not on certain species only, or on certain dead or decaying vegetables alone, but also those which flourish upon several or many organic substances, or upon common vegetable mould, and which hence are less dependent upon fortuitous circumstances for their especial soil, appear to affect particular latitudes, and to abound more or less in different regions, and to be wholly absent from various places.

(732.) The little knowledge we possess upon this point already proves that most of the extra-European fungi are distinct from the European kinds; some few of those indigenous to Barbary, and in similar latitudes in North America, are identical with ours, but the majority are specifically distinct. This, which might have been anticipated, is however a fact, that it is important to have proved; for thus only can any rational account be given of various phenomena familiar to the physiological botanist and the practical gardener, but which are not the less curious because they are common. Certain exotic plants remain free from blights, *i. e.* from the attacks of insects and parasitic fungi; while native vegetables, in the same field or garden, are profusely covered by them, and oftentimes consumed: in such a case the plants have been brought here, but their parasites have been left behind. Again, many exotic plants are not exempted, because either their parasites have been imported with them, or they have found in a foreign land others that, if not identical with those of their native climes, are equivalent in their functions, and which in different places perform reciprocally the duties of each other, as they are severally absent.

(733.) But, so little have the fungi hitherto been studied in tropical regions, or indeed in any countries out of Europe, that, of the extra-European species, there is absolutely next to nothing known. I am therefore most happy to learn, from my friend, Dr. Harlan, of Philadelphia, that Drs. Schweiniz and Torrey, both well-known and very able botanists, are prosecuting their researches amongst

the American fungi; and doubtless a rich harvest will be gathered in the vast wilds of that magnificent country, on which England, nay Europe, looks as the coheiress of her language, literature, sciences, and arts.

(734.) The chief geographical generalizations with regard to the fungi which can as yet be made are very few; they are not, however, wholly unimportant.

(735.) Fungi chiefly affect northern latitudes, and the northern parts of the temperate zone. They are much more numerous in Sweden than in France; more common in France than in Italy and Spain; and still less abundant in Barbary, and the northern parts of Africa, than in Europe. Within the compass of a square furlong in Sweden, Fries states that he found no less than two thousand species; and, although not equally multitudinous in all extra-tropical countries, they are much more numerous in the temperate than in the torrid zone. To this a parallel may be traced in the seasons which here are most favourable to their growth; for, in England, fungi are comparatively rare in summer, but occur in our forests and our fields, and in almost every possible locality, in the extreme of profusion during autumn, and even in the beginning of the winter months.

(736.) The *Sphærinæ*, and some of the *Mucedinales*, which cover the leaves and bark of many trees during the summer here, and which abound on decaying food in every season, may seem to offer serious objections to the above general law. On the contrary, however, they confirm it; for the *Sphærinæ* are those lichenöid fungi which were excluded by De Candolle from the class, and associated with some few lichens to form his intermediate group Hypoxyla; and which, as they are abundant during our summer, are common also in every part of the world where there are vegetables for them to grow upon.

(737.) Like other plants of which more is known, the geographical range of the several orders, sections, types, and genera of fungi, appear to be very different, and yet to be subject to general laws; for some, as the *Sphærinæ*, *Agaricinæ*, and *Tremellinæ*, are almost cosmopolites; while others, as the *Tuberaceæ*, the *Helvellaceæ*, and the *Clavariaceæ*, although not wholly, are chiefly European plants. This difference of range, which is evident in some of the types and sections, is also noticeable in many genera and species: thus the common mushroom, *Agaricus campestris*, is spread over the whole of Europe, and part of Asia, Africa, and America, reaching as far north as Lapland, and as far south as Barbary and Japan. The *Schizophylla*, also, which are found throughout the whole of

Europe and Asia, occur likewise on the Gold Coast and at the Cape of Good Hope, as well as in the Antilles, and in North and South America; and the truffle, which is so especially European, is also a native of the East Indies and Japan. On the contrary, *Batarrea*, one of the Phallaceæ, has only been found in England, and is very rare even in its special habitat; and *Onygena*, a curious fungus, has never yet been discovered anywhere but on horses' hoofs, lying to rot in shady places.

(738.) Equinoctial countries are not, however, destitute even of the larger fungi, and some of the tropical species are remarkable both for their form and size. "The huge Boleti of Java," we are told, "spread out their many-handed bodies from the trunks of aged trees, like vegetating demons;" and some of the terrestrial fungi of warm countries are so large, that travellers report they have been mistaken for sleeping lions. Nevertheless, although not absent, fungi are much less common near the equator than in higher latitudes; for in some intertropical places they are extremely rare, and in others perhaps unknown.

(739.) No fungus has hitherto been found in a fossil state. Nodules of iron pyrites, which assume almost every possible diversity of form, have sometimes been mistaken for fossil fungi; and indeed, their occasional resemblance to certain species, as the Agaricus pratensis, is very close, [vide § 600, fig. H, I.] But the multitudinous shapes the nodules assume, the situations, and abundance in which they are found, and, above all, their chemical constitution and the absence of any traces of organization, preclude the idea of their being the remains or casts of fungi. In Lindley and Hutton's valuable work, a fossil is figured under the name of *Polyporites* [Pl. 65], which, if indeed a fossil fungus, would be most valuable, as being the first ever yet discovered. But Mr. Bowman, who found it among the ejected shale of a coal-pit, near the entrance of the vale of Llangollen, in the county of Denbigh, and who subsequently met with a second and more perfect specimen, points out their resemblance to the scales of fish, or of some great Saurian reptiles. Hence, notwithstanding their similitude in a few respects to the recent genus *Polyporous*, much doubt is reasonably entertained of their vegetable origin: and further evidence must be adduced, before they can be acknowledged as fossil fungi.

(740.) The absence of fungi from the more modern strata may be satisfactorily explained, by the consideration of the very fugacious nature of most, and the more or less perishable structure of the remainder. Few are known which would be likely to retain their forms, when carried into lakes and seas, long enough to be sealed up by successive deposits in the heart of nascent stone. In the older series, fungi could not be expected to be found; for, as they are aerial plants, those strata in which aquatic Algæ alone have been discovered, would be very unlikely situations for fungi; and as fungi are chiefly parasitic on trees, shrubs, and herbs, it would be folly to seek for them in the deposits of epochs in which terrestrial vegetables did not exist: furthermore, as fungi now are known to affect the colder regions of our globe, and to be comparatively rare in our warmer latitudes, the older the strata in which fossil plants are found, as they indicate a temperature higher than the present, the less and less likely will they be to contain any fossil fungi.

OUTLINES OF MUSCOLOGIA.

(741.) Moss, Mousse, Muscus, and other synonymes in other tongues, had once a far more extensive meaning than they now possess; for not only were the mosses properly so called included in their ample sweep, but all kinds of soft and capillary plants, whether growing in the sea, in rivers, in swamps, or on dry land, were considered mosses, and even the places in which they grew received similar denominations: hence, to the present day, large tracts of boggy country, both in the British Isles and in the northern parts of Europe, are commonly known as Mosses.

(742.) Most of the ancient sea and river mosses have already been proved to be Confervæ; many of the terrestrial ones, as the rein-deer and Iceland mosses, have been shewn to be Lichens; the parasitic mosses, forming mouldiness or mildew, have been demonstrated to be Fungi; and the club-mosses will hereafter be found, in like manner, to be associated with the Ferns. Thus restricted on every side, the ancient indeterminate and undefinable group once called mosses has been reduced to a definite and natural modern class: which, although relatively diminished in extent, has been hindered, by recent discoveries, from becoming absolutely lessened in the number of known plants that it includes.

(743.) As was the case with both the Algæ and the Fungi, some systematic writers would confine the *Musci* within much narrower limits than it is here proposed to draw. That is, as they would consider the *Fucales* the only *true Algæ*, and the *Boletales* the only *true Fungi*, so, among the mosses, one order alone has been termed true mosses (*musci veri*), and the others altogether excluded, and deprived of the common name.

But, as in the previous instances, of the Algæ and the Fungi, so likewise here, among the Musci, the several subordinate groups can

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be equally well distinguished when considered orders of one common class, as when no such association is acknowledged; and furthermore, as such a distribution not only shews their natural affinities, but is also sanctioned both by popular acceptation and by many of the highest botanical authorities, they will be here admitted as the individual orders which form, collectively, a common class. Respectively, they are called *Hepaticales* (or liver-worts); *Bryales* (true-mosses, or moor-worts); and *Charales* (or stone-worts.)

(744.) Characteristically different as the mosses are from both the Algæ and the Fungi, and no class possesses more decided diagnostic signs, they still exhibit, especially in the two boundary orders (the liver-worts and the stone-worts), several very strong connexions with some of the foregoing groups, and more particularly with the *Confervales* and *Lichenales* of the *Algæ*. Indeed, the *Charas* are even now, by Agardh, Esenbeck, and Ebermaier, placed among the *Confervaceæ;* although they little accord with their general definition of the *Algæ*, and a much more important affinity has been pointed out with the Equisetaceæ of the following class. Again, the Liverworts were by many of the older writers once thought to be so intimately allied to the Lichens, that some of them were called, by Fabius, Dillenius, &c., *Lichen alter*, *Lichenöides*, and *Lichenastrum*, while Linnæus collectively named the whole *Algæ Hepaticæ*, a term which modern writers have changed for *Musci Hepatici*, the Liverworts, or Hepatic mosses.

HEPATICALES.

(745.) The known Liverworts are comparatively few in number; the entire catalogue of British and foreign species does not amount to 240. These are distributed into thirteen genera, one of which, viz. *Jungermannia*, contains 199 of the species; so that there are but thirty-eight left for the remaining twelve. Out of these *Marchantia* takes ten, *Lejeunia* and *Riccia* each seven, *Fimbriaria* five, *Anthoceros* two; and, consequently, seven genera, viz. *Lunularia*, *Grimaldia*, *Targiona*, *Corsinia*, *Monoclea*, *Blandovia*, and *Sphærocarpus*, each include but a single species.

(746.) So small an order needs but little subdivision; and, were it not for some peculiarities of structure, the genera might all be kept without any analytic hindrance in a single type, as they are in a single section.

HEPATICINÆ.

(747.) The stages of evolution by which a passage is effected from the Lichens to the true mosses may be regarded as characterizing three natural groups, and these, from their normal genera, *Riccia*, *Targiona*, and *Marchantia*, may be called the *Ricciaceæ*, *Targionaceæ*, and *Marchantiaceæ*.

(748.) Ricciaceæ. Differing widely as all the mosses do from the Lichens in their organs of vegetation, their herbaceous fronds exhibiting a rich lucid green in place of the dry coriaceous thallus of *Cetraria*, the wild dishevelled locks of *Usnea*, or the powdery crusts of Opegrapha and Graphis, still there are found, as already stated, some curiously interesting species in the genus Riccia, which more particularly mark the transition from the foliaceous Lichens to the Liverworts. As far as observation hitherto has gone, the fructification of the Ricciæ is imbedded in the fronds, and this character it is which shews the affinity of these plants with Endocarpon of the Lichens, and establishes them as the connecting links between the Algæ and the Musci; while it beautifully traces the transition of the preceding into the present class.

As was the case with Lepraria among the Lichens, as well as with several other instances already mentioned, no fructification has been yet discovered in some species of Riccia, but in others it is peculiar and distinct.

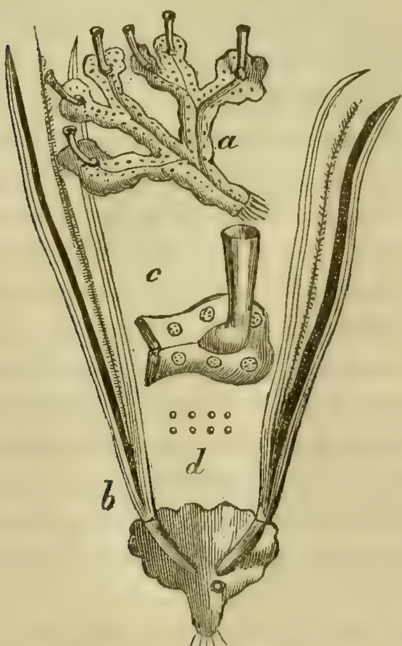
(749.) In *Riccia glauca*, for example, numerous small points are found scattered over, and projecting from, the surface of the leaf-like fronds. These are called *Setulæ*, (sometimes styles, the reason for not adopting which term will be evident hereafter, when the nature of the true style has been explained). Below the setules, immersed in the substance of the frond, are seated cases called *urns* or *thecæ*, in which the sporules are contained. These *urns* are indehiscent, or open only by decay and rupture.

(750.) The indehiscent immersed thecæ distinguish the Ricciaceæ from the other types; they are also, of course, the generic characters of the solitary genus Riccia.

(751.) The Ricciæ, which have been named in memory of Ricci, a Florentine botanist, are for the most part fresh-water plants; some, as *glauca* and *spuria*, grow on shaded rocks, in bogs among mountains, or in other damp places. No use has hitherto been made of them, and their properties are unknown.

(752.) Targionaceæ. The *Thecæ*, or *Urns*, which in the

Ricciaceæ are immersed in the frond, become, in the several genera of the succeeding type, more or less exserted; the stalk, on which the theca thus is raised, has been called the *pedicule*, *urn-stalk*, or *theca-pode*. The urns are dehiscent by valves [fig. *b*], in the four genera contained in this section, called the *Targionaceæ*. In *Monoclea* (a foreign genus), the urn consists of only one piece or valve (theca, or urna univalvata.) In *Anthoceros* (the flower-



(*a*) *Jungermannia pusilla*, or *Blasia pusilla*.

(*c*) Ditto, portion in fruit magnified.

(*d*) Sporules.

(*b*) *Anthoceros punctatus*, shewing the two valved urns and the columella, to which the sporules are attached.

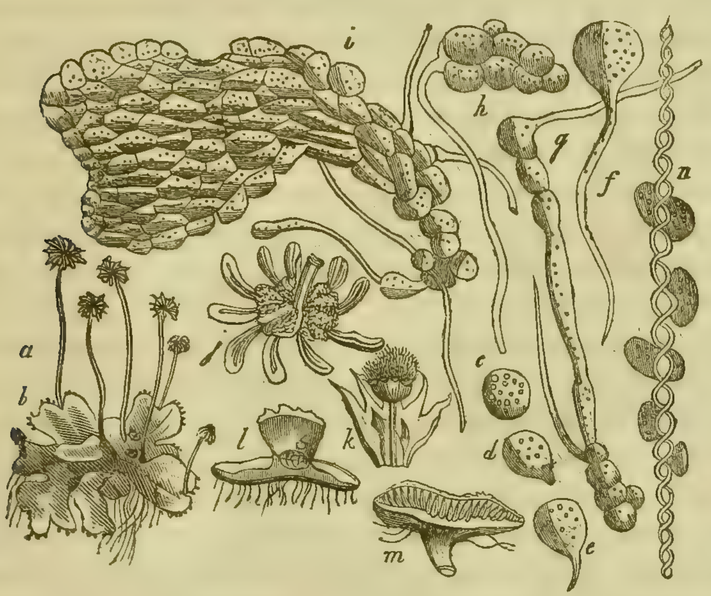
horn), it divides into two (urna bivalvis), as likewise in *Targiona*. Covering the urn in its early stages, and often surrounding its base when more fully developed, there is found a cup-shaped elevation of the frond called a calyx (or rather a calycel), of which there is no trace in the *Ricciaceæ*. In two of the genera, viz. *Targiona* and *Monoclea*, the *sporules* are accompanied with numerous spiral threads called *Elateres*, shewing thus the greater affinity of these with the Marchantiaceæ [§ 753, fig. *n*,] than can be claimed for Anthoceros and Sphærocarpus, in which no Elateres are found. The genera with Elateres form the *Targionidæ*, while those destitute of these spiral threads constitute the subtype *Anthoceridæ*.

Their veil-less urns associate these genera, and distinguish this from the following type.

(753.) Marchantiaceæ. Two genera named after *Jungermann* and *Marchant*, the latter of whom was the first foreign botanist

that the French Academy of Sciences admitted amongst its members, are distinguished from the preceding section by the presence of two coverings to their urns or thecæ, the outer one, or calycel, analogous to the calycel of the *Targionaceæ*, the inner a new organ named by botanists *calyptra*, or *veil:* the calycel is some-

Marchantia polymorpha.



(*a*) The *peltapode* springing from (*b*) the frond, and bearing the *pelta* or *shield;* which is the common receptacle of many urns. (*j*) A pelta or shield reversed. (*k*) A *theca* supported on its *thecapode,* and surrounded by its *calycel,* or *perichætium,* having burst through its *calyptra.* The Elateres and sporules are shewn by the dehiscence of the urn, the edge of which is notched into about eight teeth. (*l*) Portion of the frond elevated, and forming a receptacle or origoma, in which are contained small bodies, believed to be equivalent to buds or bulbils. (*m*) A shield bearing *urnulæ* or *pseudo-thecæ.* (*n*) *Elateres* with sporules. (*c*) A sporule swelling previous to germination. (*d, e, f*) *Sporules* in different stages of development. (*g*) An instance of irregular growth. (*h*) Regular growth, showing the maternal vesicle, and those subsequently formed. (*i*) The foliaceous frond produced by the further development of cellules, at first similar to the sporules, but subsequently changing their spherical forms for multangular figures.—*(Mirbel's Monograph).*

times obscure or absent, the calyptra never abortive. Marchantia is frondose in all its species, although the fronds are deeply divided, giving them a more or less foliaceous appearance [fig. *b.*] From the frond arises the common receptacle of several urns [fig. *a*]: the expanded summit of this common receptacle is called the pelta or shield [fig. *j*], and the elongated base or stalk [fig. *a*], the *peltapod.* The urns or thecæ are covered by two membranes,

the calycel [fig. *k*] and calyptra, and contain numerous sporules mingled with elateres [fig. *n*.] Besides the regular urns, there are other organs found on peltate receptacles, which have not always peltapods, and are supposed to shew some analogy to parts hereafter to be described under the name of *Anthers* [fig. *m*.] But their use is not well known, and hence their better name would be urnulæ or pseudo-thecæ. Sometimes the urnulæ are found as in *M. androgyna*, a variety of *M. hemisphærica*, on the upper surface of one half of a shield, the lower surface of the other half of which bears the urns or thecæ. The fronds are also studded with knots, or *gongyles* [fig. *l*], which germinate even while attached to the parent plants. These vegetables are therefore viviparous as well as oviparous. The buds are surrounded by variously-shaped foliaceous projections, called by some persons origomæ or origomes.

(754.) Jungermannia, the other genus, has no common receptacle collecting its thecæ together, but each urn is raised upon its own seta, Chætium or Thecapode, and dehisces or opens by four valves [§ 59, fig. A]. The perichætium is sometimes, but rarely, abortive in the Jungermanniæ, the calyptra is always present. One subdivision of this genus contains frondose plants, resembling the Marchantiæ, while another developes the foliaceous projections in the manner of leaves marking the transition of this type, the *Marchantiaceæ*, to the next that follows, viz. the *Andræaceæ* of the commonly called true mosses.

(755.) The foliaceous productions that surround the thecapode are called the *perigonial leaves*, or perhaps better, the *perichætium* or perichætial leaves, as investing or being set round the *seta*, or *chætium*. In the axillæ of these perichætes there are generally found minute spherical bodies of a membraneous reticulated texture, which, like the false urns or pseudo-thecæ of Marchantia, have been called anthers. It is however better, as nothing is really known of their use, to call them, as in the previous instance, not *anthers*, but *urnulæ* or *pseudo-thecæ*.

(756.) The Jungermanniæ are small obscure plants, growing in damp situations, creeping over the trunks of trees, the surface of rocks, or the moist earth, and which seldom attract much notice. The monograph of Hooker upon the British Jungermanniæ has, however, elevated them from their obscurity, and shewn these neglected plants to be among the most exquisite examples of Nature's works.

None of them are poisonous, or in the slightest degree hurtful; their taste is mild: some few, as the *J. pusilla*, are fragrant, but not possessed of any very sensible properties. Not one of the species has hitherto been applied by man to any useful purpose.

(757.) The study of these plants has therefore sometimes forcibly struck me as being a more decided proof of a disinterested love of science, than the investigation of other richer and more directly rewarding tribes. The Jungermanniæ afford neither clothing nor fuel, they yield neither food for the hungry nor medicine for the sick. Hence they have been contemned as useless, and their study proscribed as a useless occupation. But is it so? Are they altogether worthless? Are there not functions performed by these, and many other plants, *as worthless*, which are of vast importance in the general economy of nature? functions which indirectly, if not directly, minister to the comforts and conveniences of man. The uses which nature makes of plants are often more beneficial to us than any uses we can make of them ourselves: and should aught created be despised as useless, by those whose ignorance alone it is that, in all likelihood, prevents them discovering its utility?

But there is a use in studying the works of the Creator far beyond the discovery of the uses to which these, his creatures, may be applied; far beyond the discovery even of the blessings he has provided for our enjoyment: for when they afford neither sustenance nor physic for the body, they yield both food and medicine for the mind. "Do not, therefore, depreciate any pursuit which leads man to contemplate the works of God." To the merchant, the courtier, or the bookworm, the journal of a naturalist may appear to contain memoranda of little importance. But to such, if they scorn his labours, he may answer in the words of Southey, that he has "in his pursuit, as they in theirs, an object that occupies his time, and fills his mind, and satisfies his heart. It is at least as innocent as theirs, and as disinterested—perhaps more so, because it is not so ambitious." Nor can the pleasure he feels in the discovery of a plant, or in the investigation of its wonderful structure, be less pure or less worthy, than what they derive from the perusal of the noblest productions of human genius: nay, is it not likely to be both more pure and more worthy?

(758. The Marchantias seem to have been formerly regarded as the more especial Liverworts; they being called *Hepaticæ* and

Jecorariæ, while the frondose Jungermanniæ were termed *Hepaticöides.* The signature physicians attributed wonderful curative powers to these plants, especially to the Marchantia polymorpha; the lobulated fronds of which species, from a fancied resemblance to the liver, caused it to be esteemed a specific in jaundice, and other hepatic complaints. Since signature medicine has been exploded, the liverwort has fallen in this country into unmerited neglect; but it is still retained as an officinal plant in Germany. It has a very penetrating, though mild pungency, and bitter taste. It is both cathartic and diuretic, and appears to possess no inconsiderable virtues.

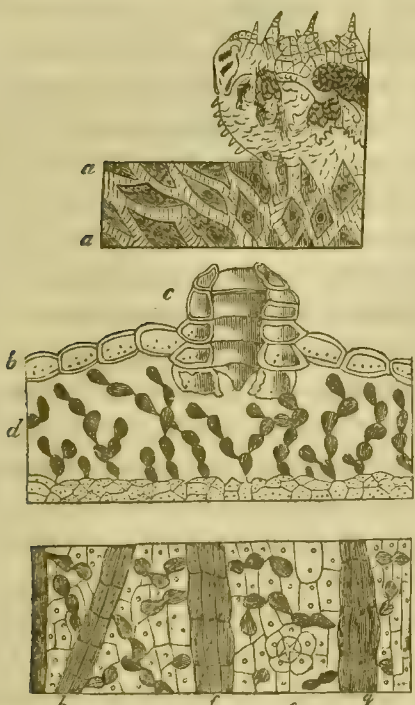
(759.) Although discarded by the learned from their lists of remedies, the liverworts have never been entirely lost sight of as domestic medicines. In our provinces, and in Ireland, as well as in Germany, they have always maintained their reputation.

Induced by this popular belief, and persuaded by the representations made to him by one who had personally witnessed its good effects in dropsy, Dr. Thomas Short determined to give the *Marchantia hemispherica*, another species of liverwort, a trial in some of those cases which he had failed to relieve by the usual means, and in which it was said to afford often the most decided benefit. After an extensive trial for several years, the report which he has published is most satisfactory. He did not find it so efficacious when internally administered as others are said to have done, but externally applied in the form of poultice, he says, he found it "astonishingly successful;" and therefore, although, like other diuretics, it has sometimes failed to cure, he considers it on the whole as of great value as a remedial means.

He directs the poultice to be made by carefully picking and washing about two large handfuls of the liverwort, which are to be put into a quart of boiling water, and simmered for twelve hours, adding more water as it may be required. The leaves are then to be beaten into a pulp, and as much linseed-meal stirred in as will bring the mass to a proper consistence. The poultices, spread on flannel, may be applied either to the abdomen or the legs, or to both as occasion may require, and should be renewed every twelve hours until the water has been drained off, or the application proved to be ineffective, which will become evident in the course of two or three days. The ordinary effects of these cataplasms are, first, to produce copious perspirations, and secondly, to act powerfully on

the kidnies. Tight bandages should be wound round the body in cases of abdominal dropsy; otherwise a feeling of exhaustion, as is common after tapping, may come on. Dr. Short says, he was not accustomed to exhibit any medicines internally, while the poultices were being used, unless the sense of sinking just mentioned became distressing; when, although he never knew any harm to follow, he gave small doses of the nitrous spirit of ether. The effects of the liverwort, he says, were much increased by the free exhibition of warm diluents, and those which are slightly nutritious, seemed to be the most beneficial. In conclusion, he adds, that the plan of treatment he describes appeared to be most successful in cases in which other remedies had been extensively employed and failed.

(760.) *Marchantia polymorpha*, has lately been rendered peculiarly interesting in a physiological point of view, by Mirbel having shewn, in a memoir just published, that certain organs called *Stomata* exist in this plant, which were previously denied to be present in any of the mosses or their allies, indeed in any vege-



(*a, a*) Portion of the frond *Marchantia polymorpha*, with a section of one of the cup-shaped receptacles containing buds, called by some persons an *origoma*. The surface is divided by green lines into lozenge-shaped compartments, in each of which is a large stoma.

(*b*) Transverse section of the frond, shewing the upper and lower cellular layers.

(*d*) Ditto, intermediate cellular structure, the cells in lines with intervening passages.

(*c*) Section of a stoma across its smallest diameter, to shew the cellular structure of which it is formed, and the opening into the air-chamber.

(*e*) Air-cells and stomata.

(*f, g, h*) Bands of cellular structure which bound the air-chambers.

tables lower in the scale of creation, than the ferns. He has, however, proved that they not only do exist, but that they exist in perfection; and, in tracing their evolution, he has thrown much very

important light upon an obscure branch of vegetable structure. Mr. Griffith has likewise found Stomata in *Targiona hypophylla.*

(761.) The three groups now enumerated and described, are associated in the common order *Hepaticales*, an order which is readily distinguished from the succeeding, by the urns in all the genera being destitute of an organ call *an operculum*, or lid [§777, fig. *c*, *i*], which is universally present in the *Bryales.* Hence the liverworts have sometimes been called *Musci de-operculati*, while those genera, included in the next order which all have lids, have been named the *Operculate* mosses. With the stoneworts which are submerged leafless plants, having indehiscent axillary fruits, they can never be confounded, [§ 786.]

(762.) Although confessedly alike each other in habit and in their organs of vegetation, the organs of fructification in the liverworts, as will have been already observed, are so different, that a question arises as to whether the three groups, in which they are arranged, should not be considered three *sections* of the order Hepaticales, rather than three types of the same section. Riccia, whose immersed urn dehisces only by rupture, contrasts most strongly with the other groups, in both of which the urns are discrete and mostly dehisce by valves. And although the valvular dehiscence is common to both these, in Targiona and its allies, the urns are veil-less: while in Marchantia and its allies, they are veiled; all characters sufficiently strong to distinguish sectional groups. Moreover the two genera, *Jungermannia* and *Marchantia*, which are contained in the first, differ so widely by the former having the urns solitary, and in the latter collected upon a common peltate receptacle, that they might justly claim to be considered the normal genera of separate types. The urns of *Targiona*, *Lunularia*, *Lejeunia*, *Fimbriaria*, and *Monoclea*, containing elateres amongst the sporules, while in *Anthoceros*, *Corsina*, and *Sphærocarpus* there are none, have already been mentioned as characters by which this might be divided into two subordinate groups. And as to *Riccia*, it is a genus in its type alone.

But as this is a question as to the extent to which analysis should be carried, and the degree of similitude that should be required in plants synthetically associated in the more or less comprehensive groups, which come between the genera and classes, it is one in which speculation too freely mingles to afford a reasonable hope that it will ever be settled to the satisfaction of all.

BRYALES.

(763.) This order includes those mosses to which, alone, some persons would confine the name, and the study of which, alone, would thus form the extent of their muscology. But as the words *Lichenologia*, *Phycologia*, &c. are occasionally used to designate the especial studies of the *Lichenales* and *Fucales*, of the *Algæ*, so *Bryologia*, an equivalent term, is one as common and far more appropriate for this subdivision of MUSCOLOGIA, whenever it requires a distinct denomination. For these *Foliose* or *Operculate* mosses, the Brya (Βρυα) of the Greeks and Romans, form the BRYALES of the present scheme; and the *Bryaceæ*, *Bryöideæ*, &c. of Bartling, Reichenbach, and other authors. That they have no prescriptive right to the exclusive possession of the title, "True Mosses," (Musci veri,) has been already shewn: and why they should ever, for the sake of distinction from the Hepaticæ, have been called *frondose mosses*, it is difficult to conceive, as not a single example can be cited which has a *frond*, while the majority of the liverworts really are *frondose*.

(764.) The BRYALES, or *foliose-mosses*, are easily distinguished from the *liverworts*, by the possession of an *operculum* (or lid), which covers the *urn* (or theca), in which are contained the seeds (or sporules.) They are much more numerous than either of the allied orders, and are therefore distributed into three sections, which are distinguished by the varied dehiscence of the urns. From the normal genera, *Andræa*, *Bryum*, and *Phascum*, these three sections are called the ANDRÆASINÆ, BRYACINÆ, and PHASCINÆ.

(765.) Before describing the variations in form which characterize the several types and sections of this order, it will be advantageous to give a slight sketch of the general structure of the whole, because a considerable advance is here made in the evolution of organs, some of which are perfected which were only commenced in the liverworts; and hence many new terms are required in their description.

(766.) The lower part of the general axis in mosses is prolonged into a fibrous root, entirely composed of cellular structure [§ 59, B.] The ascending axis is called a *surculus*, not frond, as in the liverworts, because the thecæ spring from the axis, not from its foliaceous expansions; an effort towards which is seen in the higher Jungermanniæ [§ 50, A.] The regular divisions [§ 768, *a*] of the general axis are called *branches*, those which are irregular *innovations;* and the foliaceous appendages, of which no moss is entirely destitute, *leaves*. Beneath, and among the leaves, are

small foliaceous productions called Stipules. The fructification is of two kinds [§ 59, B], as in the liverworts: the small spherical bodies lodged in the axillæ of the leaves have been called *Anthers*, to which name, however, there is a serious objection, and it may be better, as before, to call them urnules or false urns. The *thecæ*, or true urns, are either sessile, or supported on a bristle [§ 59, B], which is named the *seta* (or chætium), and the leaves which surround the seta (or chætium) the *perichætium*. The urn or theca is closed by a lid, named *operculum* [§ 774, *b*; 777, *i*], and covered by a veil, *Calyptra*. The Calyptra opens in different ways; it is either irregularly torn, as in *Andræa* [§ 768, *e*], entire at the base, or only shewing some short clefts, as in *Splachnum*, when it is called *Mitral* [§ 780, *e*]; or if one long cleft extends upon one side only as in Tortula, Polytrichum, Hypnum, and many others [§ 778, *i*; 774, *a*, &c.], then it is termed *dimidiate*. The vaginule is the base of the calyptra, which remains within the perichætium at the base of the urn after the upper portion has been torn away and elevated by the growing theca [§ 781, *c*.]

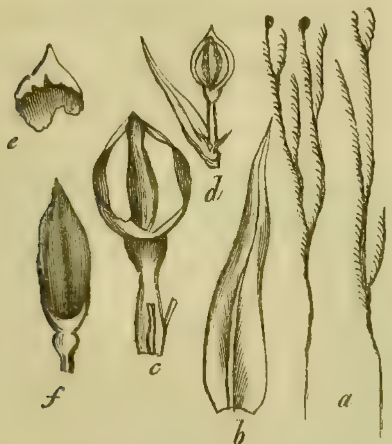
(767.) The opening of the theca to discharge the spores that it contains is called its *dehiscence*. In one section it dehisces longitudinally by valves [§ 768, *c*, *d*], in another, transversely at the junction of the operculum [§ 777, *i*], and, in the third, [§ 769, *d*,] it is indehiscent; the sporules only escaping on the solution, rupture, or decay of the thecæ.

When the operculum or lid is removed, the opening into the urn is seen, which is called its mouth or *stoma*, [§ 780, *d*,] which is sometimes naked, [§ 781, *c*, *f*,] at other times set round with a fringe, called *peristome*, which is either double or single [§ 777, *d*, *e*, *f*, *g*, &c.]; and, according as the processes are membranous, hair-like, or tooth-like, they have received their respective denominations. The peristome is occasionally embraced by an elastic ring (*annulus*), and sometimes has internally some delicate filamentary projections, named *ciliæ*. The sporules are attached to a prolongation of the floral axis within the urn, which is called the *columella* [§ 780, *d*], and the *sporules* are unaccompanied with *Elateres*. The urn is often enlarged on one side of the base, which swelling is called a *struma*, and, if prolonged downwards, the projection is named an *Apophysis*. The fine membrane, which is occasionally found stretched across the peristome, and closing the (stoma) mouth of the urn, as in the many-hair moss (Polytrichum), is called the *Epiphragm*.

But these numerous and very curious organs are not all present in all mosses, and, in consonance with the general scheme thus far pursued, their successive evolutions shall be illustrated by examples.

ANDRÆASINÆ.

(768.) ANDRÆACEÆ. *Andræa*, a moss that commemorates either André, a German botanist, or Andreas de Castro, physician to one of the Dukes of Braganza; or Andreas, a celebrated naturalist of antiquity, who has been honourably mentioned by Pliny,



Andræa.

(*a*) Two plants of A. nivalis, natural size.

(*b*) Cauline leaf, magnified.

(*d*) Urn and perichætial leaf, magnified.

(*f*) Unopened urn of Andræa alpina.

(*e*) Torn calyptra.

(*c*) Open urn, shewing the valvular dehiscence, and conjunctorium, or adherent operculum.

(*Hooker and Taylor.*)

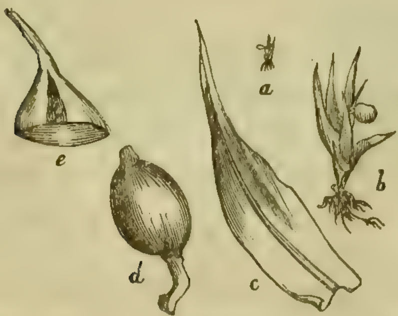
marks the transition of the true mosses from the liverworts, by shewing their connexion through it, with the Jungermanniæ and some of the Targionaceæ. For, although the stem of *Andrea*, its operculated theca, and its destitution of Elateres, distinguish it decidedly from the Hepaticales, and locate it among the Bryales; still its dehiscent urn, splitting into four valves, like Jungermannia, points it out as the osculant genus.

Thus is the gradation carried on from the foliose Jungermanniæ, by the urn of Andræa, the only genus in the type *Andræaceæ*, and section *Andræasinæ*, retaining the Hepaticine character of dehiscing longitudinally by valves; and, although possessed of an operculum or lid, the essential organ of all the Bryales, still having this lid persistent; *i. e.* not opening as a lid to allow the escape of the sporules, but connecting the apices of the valves together; and hence it is sometimes called the *conjunctorium* [fig. *c*, *d*.]

There are several species of Andræa, two, which were formerly classed as liverworts, being named by Linnæus, *Jungermannia alpina* and *J. rupestris*, and even now by some they are denominated *musci desciscentes.*

PHASCINÆ.

(769.) PHASCACEÆ. *Phascum* is the only other known British moss which retains its operculum like *Andræa*, from which genus,



Phascum curvicollum.

(*a*) Plant, natural size.
(*b*) Ditto, magnified.
(*c*) A leaf, still more enlarged.
(*d*) Indehiscent urn of P. cuspidatum.
(*e*) Dimidiate calyptra of ditto.
(*Hooker and Taylor.*)

however, it widely differs, by having indehiscent thecæ. *Voitia* and *Bruchia* are two foreign genera, which, possessing the same peculiarity of structure, are associated with it in the type *Phascaceæ*, the only one included in the section *Phascinæ*.

(770.) The generic name *Phascum* is but slightly altered from the original Greek φάσκον, the meaning of which is not, however, very obvious. The *Phasca* are amongst the most diminutive of the mosses, some of them being scarcely discernible, and others all but invisible to the naked eye. Notwithstanding their minuteness they are very dissimilar in their forms; and many so extremely curious and beautiful, that the speculative would derive φάσκον from φαω, to shine.

BRYACINÆ.

(771.) *Bryum* and *Sphagnum*, with thirty other associated genera, form the section *Bryacinæ*. This section, which is the largest in the order, and indeed much the largest in the class, includes nearly nine hundred and fifty out of the nine hundred and seventy-one species enumerated in Sprengel's catalogue. They are all, however, notwithstanding their number, easily recognized by their deciduous opercula; a character by which they are therefore readily brought together, and known from the *Phascinæ* and *Andræasinæ*.

(772.) But the *Bryacines*, although collectively known by their deciduous opercula, have very differently developed urns.

Sphagnum, and its allies, which constitute the type SPHAGNACEÆ, are like the *Phascaceæ* and *Andræaceæ*, destitute of Peristome.

Splachnum, and its allies, have a peristome, but it is single and

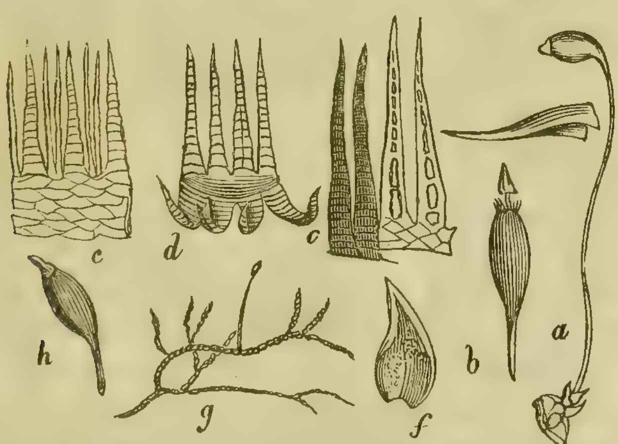
consists of one whorl only of metamorphosed leaves, which character distinguishes the SPLACHNACEÆ.

While *Bryum*, *Hypnum*, and their immediate allies, which form the type BRYACEÆ, have a double peristome; the inner being sometimes membranaceous, sometimes formed by *ciliary processes*, and sometimes of teeth similar to the outer peristome.

(773.) BRYACEÆ. *Hypnum* (the feather-moss), and *Bryum* (the thread-moss), two of the largest genera in this order, and, excepting *Jungermannia*, the most extensive in the class, although associated by their double peristomes, differ in a character which by some Bryologists is deemed of primary importance; that is, in *Bryum* the thecæ or urns are terminal, [§ 777, fig. *a*; 778, *a*, *d*,] while in Hypnum they are lateral, [774, *g*.] Desiring as far as possible to derive the associating characters from the fructification, by which the most natural groups are formed, the relative position of the thecæ is here only esteemed a subordinate diagnostic sign, distributing the *Bryaceæ* into two subtypes. *Hypnum*, with Hookeria, Daltonia, Neckera, Fontinalis, and others, in which the urns are lateral, are thus associated to form the subtype *Hypnidæ;* while *Bryum*, with Polytrichum, Funaria, Orthotrichum, and Buxbaumia, in which they are terminal, constitute the subtype *Bryidæ.*

(774.) *Hypnidæ.* Of the hundred and twenty-nine species of Hypnum, there are very few that minister directly to the wants of man. *H. triquetrum*, from its extreme elasticity and lightness, is much used for packing brittle wares. *H. purum* is used by anglers

Hypnum.



(*a*) H. rutabulum with urn, operculum, and calyptra. (*b*) Urn and operculum of H. dendröides. (*c*) Portion of peristome of ditto. (*d*) Inner peristome of H. complanatum. (*e*) Ditto of H. rutabulum.

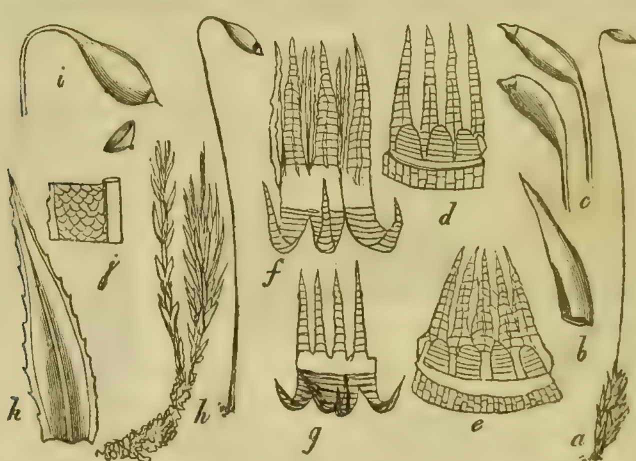
for the purpose of scouring worms, whence its specific name; true Waltonians prefer this species; half-bred anglers use it indiscriminately with other mosses. *H. proliferum* is greatly employed for insuring the safe transport of leeches; they travel with far less injury when protected by the moss, than when in vessels of water only.

(775.) Johnston states, in his very interesting Flora, that the petrified moss so abundant in the neighbourhood of Berwick-upon-Tweed, is the *H. commutatum*: tufts of which are encrusted and solidified by a deposition of the lime thrown down from the water in which it grows. It delights to hang over the precipitous fronts of dripping rocks, or of small cascades whose waters strain themselves through the dense and plumy foliage as through a sponge. Leyden must have had it in view when he wrote the "Listless Shepherd."

> "His is the lulling music of the rills,
> Where drop by drop the scanty current spills
> Its waters o'er the shelves that wind across,
> Or filters through the yellow hairy moss."

(776.) The *Fontinalis antipyretica*, is employed in Sweden to fill up the spaces between the chimney and walls, and thus by excluding the air, it prevents the action of the fire upon them. Hence it derived its specific name *antipyretica*, which has led to the erroneous idea that it is absolutely incombustible.

(777.) *Bryidæ*. The *Brya* are plants of exquisite beauty, often



(*a*) Bryum cæspiticum, natural size. (*b*) Calyptra of Bryum triquetrum. (*c*) Urns, with opercula of B. triquetrum and B. palustre. (*d*) Peristome of B. ventricosum. (*e*) Ditto of B. elongatum. (*f*, *g*) Portions of the peristomes laid open. (*h*) Bryum hornum, natural size. (*i*) Theca, and operculum. (*j*) Portion of leaf, shewing cellular structure. (*k*) Whole leaf, magnified. (*Hooker and Taylor*.)

resembling in miniature the forms of some of our noblest palms and forest-trees. The *Funariæ* are very common, especially the F. hygrometrica, which is met with almost everywhere. It, however, chiefly luxuriates in those soils which have been charred, or where wood has been burned. The fruit-stalk is possessed of remarkable hygrometric properties, and indicates very slight variations of atmospheric moisture. From its thus becoming twisted like a cord (funis), its name Funaria has been derived.

(778.) Polytrichum is another large genus contained in this subtype. Johnston, to whose work I am indebted for much economical information of importance, says, in the north of England mattresses superior to those of straw are sometimes made with the Polytrichum commune, and we have seen door-mats, and very neat brushes, made of the luxuriant stems collected from bogs. "When well combed and dressed, (says Mr. White, in his Natural History of Selborne,) and divested of its outer skin, it becomes of a beautiful bright chestnut colour, and being soft and pliant, is

Polytrichum.

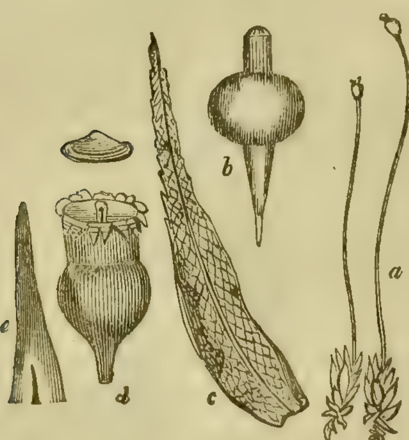
(*a*) Plant of P. piliferum, shewing the theca, and operculum.
(*b*) Point of leaf.
(*c*) Whole leaf magnified.
(*d*) Plant with calyptra.
(*e*) Calyptra of P. commune.
(*f*) Urn of the same.
(*g*) Ditto of P. undulatum.
(*h*) Mouth of the urn, shewing the peristome.
(*i*) Calyptra of the same.

very proper for the dusting of beds, curtains, carpets, hangings, &c. If these besoms were known to the brush-makers in town, it is probable they might come much into use for the purpose above mentioned." Such brushes are now very often made.

(779.) To the Laplanders the services of this moss are much greater than to us, for it affords them both "bed and bedding." They choose the starry-headed plants, out of the tufts of which they cut a surface as large as they please for a bed or bolster, separating it from the earth beneath; and, although the shoots are scarcely branched, they are nevertheless so entangled at the roots as not to be separable from each other. This mossy cushion is very soft and elastic, not growing hard by pressure, and if a similar portion of

it be made to serve as a coverlet, nothing can be more warm and comfortable. "Mollissimus est hic lectus cujus stragula undique ambiunt corpus et ad illud sese ubique applicant; calidissimus deinde est, ut virentis vegetabilis grati odoris, nec pediculos, pulices, cimices, scabiem, luem, aliudque contagium innocenti corpori adfert, nec plumulis undique obvolitantibus irresolubilibusque, cum inspiratione, pulmones infarcit phthisinque generat, sed lassum corpus molli grataque requiæ reficit." I have often, continues Linnæus, made use of it with admiration; and, if any writers had published a description of the simple contrivance of the Laplanders, (which necessity has taught,) I could almost imagine that our counterpanes were but an imitation of it. They fold this bed together, tying it up in a coil that may be grasped by a man's arm, which, if necessary, they carry with them to the place where they mean to sleep the night following. If it becomes too dry and compressed, its former elasticity is restored by moisture. *Polytrichum commune* is slightly astringent, but is not now used here in medicine. In Germany it is esteemed as a sudorific. At one time it was famed for promoting the growth of hair; which it doubtless does as effectually as the modern celebrated nostrums.

(780.) SPLACHNACEÆ. All the *true Mosses* with dehiscent thecæ, and which have only a single peristome, are included in a common type, called, from *Splachnum*, the normal genus, the



Splachnum ampullaceum.

(*a*) Two plants, natural size.

(*b*) Urn magnified.

(*c*) Leaf ditto.

(*d*) Urn of S. sphæricum, shewing the stoma and single peristome; the columella and the dehiscent operculum.

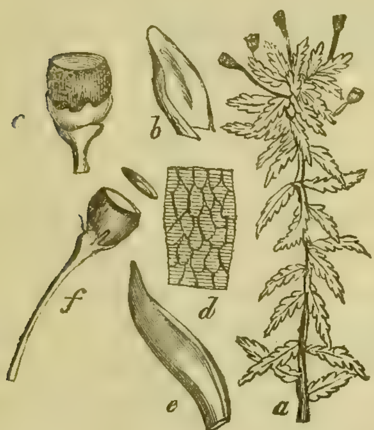
(*e*) The mitral calyptra.

Splachnaceæ. The genera thus associated differ, however, from each other in three particulars. *Fissidens* and *Leucodon* have *lateral Thecæ*, in the rest the *thecæ* are terminal; but in *Tortula*, *Dicranum*, *Conostomum*, and others, the calyptra is *dimidiate*, while in *Splachnum*, *Grimmia*, *Tetraphis*, and *Encalypta*, it is mitral. These variations, therefore, form the three subtypes

Splachnidæ, *Tortulidæ*, and *Fissidentidæ*, which the type *Splachnaceæ* comprehends.

It must however be borne in mind, that all these distinctions are only relative, and that osculant genera and species continually occur, which denote the connexions of the several groups, and the unity of the whole: thus, in the *Splachnidæ*, Grimmia unicolor, like all the other Grimmiæ, has, when young, a mitriform calyptra, but when mature, the calyptra becomes dimidiate. This peculiarity was, I believe, first noticed by Dr. Greville.

(781.) SPHAGNACEÆ. *Sphagnum*, which, with its allies, *Gymnostomum*, *Anæctangium*, &c., form the last type in this section;



Sphagnum.

(*a*) S. obtusifolium, reduced.

(*b*, *e*) Leaves magnified of two varieties.

(*d*) Portion, to shew cellular structure.

(*c*) Urn, with torn base of the calyptra, or vaginule.

(*f*) Urn, with operculum, both shewing the stoma destitute of peristome and the operculum.

from the normal genus it is called *Sphagnaceæ*, and is differentially known by all the genera it includes, being destitute of peristomes.

(782.) *Sphagnum* is a genus which differs from all other British mosses, by its perichætium being abortive, or rather, by the perichætial leaves not differing in form from the ordinary foliage. Hence, by some systematic writers, it is put into a primary group called "evaginulati," all those having perichætia being named Musci vaginulati. Here, however, the absence of perichætium merely distinguishes it as a subtype, called *Sphagnidæ*. The other genera in this type have *perichætia*, but in *Anæctangium*, the fruit-stalks are lateral, while, in *Gymnostomum* and *Schistostega*, they are terminal. Two other subtypes are therefore thus formed, called the *Gymnostomidæ*, and *Schistostegidæ*.

(783.) The *Sphagna*, or bog-mosses, are most abundant both in this country and in Ireland. They form excellent packing; and Mr. W. Curtis obtained a reward, from the Society of Arts, for his valuable discovery of the great advantages derived from the use of

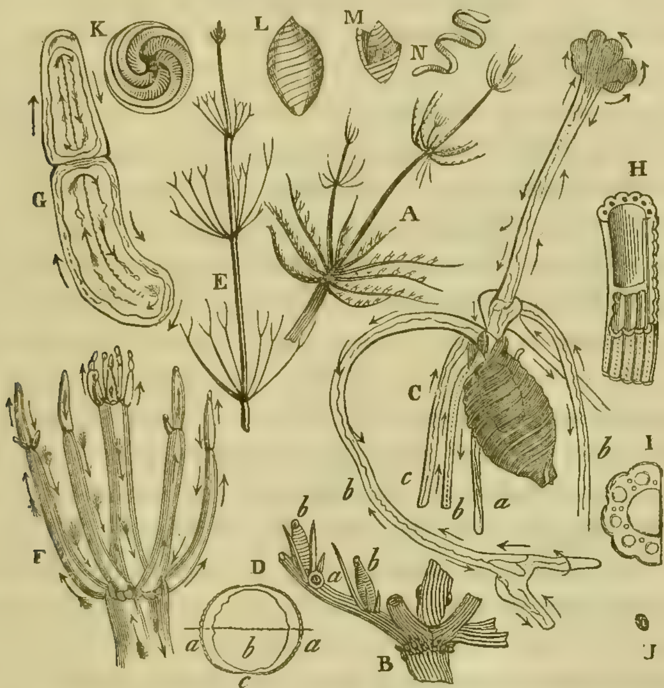
these mosses for packing young trees for exportation. The sphagna are all of a singular chlorotic hue. By the Laplanders, Icelanders, and North American Indians, they are used for lining their neat and curious cradles. In cold countries they are also employed as a warm lining or stuffing for the loose deer-skin boots which the rein-deer drivers wear. It is said that no other lining is so surely a guard from the evil effects of frost. These mosses also form a soft elastic bed, which absorbs the moisture of the body very rapidly, and thus affords such a protection from the cold of a rigorous winter, that their place would be ill supplied by cloth; and, like the polytricha, whenever these couches get hard or lumpy, it is only necessary to plunge them into the next stream or pond, when the mosses resume their turgidity, and become as fresh and elastic as ever. It is indeed owing to the rapidity with which they absorb the cutaneous perspiration, as well as all other kinds of moisture, that these beds never feel damp, and retain their elasticity for so great a length of time.

(784.) The *Gymnostoma* are curiously minute and elegant plants, scarcely visible to the naked eye; but they well reward the microscopic researches of the diligent botanist. Haselquist observed G. truncatulatum growing in vast abundance upon the walls of Jerusalem, and hazards a conjecture that it may be the Hyssop of Solomon. That our present Hyssopus is not the plant alluded to by Solomon there can be but little doubt. If Haselquist's surmise should be correct, this minute "Hyssop, springing out of the wall," would contrast finely with "the cedar that groweth on Lebanon," and thus, by referring to the extremes of the vegetable world, the phrase, by a beautiful orientalism, would comprehend the whole of which the Chronicler says that the wise man spake.

(785.) The *Bryaceæ*, *Splachnaceæ*, and *Sphagnaceæ*, (the *Musci Gymnostomi*, *Aploperistomi*, and *Diploperistomi* of Hooker and Taylor,) which differ in their double and single fringes and want of peristome, but agree in the operculate dehiscence of their urns, thus constitute collectively the section Bryacinæ, which, with the two others, the *Phascinæ* and *Andræasinæ*, (the *Astomi* and *Schistocarpi* of the Bryologists just named,) are associated to form the order *Bryales*, the *Musci veri*, moor-worts, or true-mosses, of the generality of writers. The operculate theca is, as before said, the chief collective and differential sign; their habits, and the other characters already described, are, however, further confirmations of the alliance.

CHARALES.

(786.) Certain very curious water-plants vulgarly called *stone-worts*, but to which botanists have given the names of *Chara* and *Nitella*, form an order, that, from the normal genus, is termed CHARALES. The two genera just mentioned, into which the Charas have been distributed, and which include less than forty



A. Chara vulgaris; part of a plant to shew the axis and whorled branches. B. Small portion at a joint, magnified, to shew the numerous spiral striæ on the stem and branches. (*a*) The globule. (*b*, *b*) The nucules in the axillæ of the abortive foliage. C. Another portion still more enlarged, to shew the spiral valves of the nucule, and the course of the currents in the tubes. D. Transverse section of a branch, shewing the centre tubular cavity (*b*), and the meniscöid channels (*a*, *a*), in all of which the fluids move. (*c*) The lines of demarcation. E. Portion of *Nitella flexilis*. F. Smaller portion more enlarged, to shew the simple tubilles. G. Another portion, shewing the course of the rotary circulation in each cell or tubille. H, I. Longitudinal and transverse sections of the stem of *Chara hispida*. K, L. Gyrogonites, or fossil nucules, of Chara. M. Dissection of the nucule of Chara, shewing the outer coat formed of spiral valves, and the inner body or spore, with its spiral striæ. N. One of the valves of the nucule-case separate.

known species, are all that have been as yet discovered, and the whole that this order comprehends.

(787.) But, although thus few in number, their structure is so peculiar, that every attempt to associate them with other orders has failed: and even the propriety of their location among the mosses is not unquestionable. This arrangement, however, seems

to be the most natural that has been hitherto proposed; and, when their structure is morphologically compared with that of their allies, they will be found to be much less paradoxical than has been frequently believed. Still, that their affinities are obscure, is evident from the fact, that by some botanists they have been classed with flowering plants, and by others, of equal celebrity, and even by the same person, at different times, with those which are flowerless. Thus, by Linnæus, they were at first placed among the Algæ, near the Lichens, in the class *Cryptogamia*, but subsequently removed by himself to *Monœcia monandria;* and by later Linnæans, to *Monandria monogynia*, of the Phænogamic section. Even, in the present day, De Candolle and Leman have associated the Charas with the *Exogenæ*, Brown with the flowering, and Bartling with the flowerless *Endogenæ*, while Agardh, Walroth, Martius, and others, returning to the original opinion of Linnæus, fix them among the Cellulares; some, however, esteeming them allies of the confervaceæ, and others as a distinct group more or less remotely connected with the mosses. Thus, Lindley excludes them, although leafless, from his *Aphyllæ**, and associates them with the true mosses and liverworts, as the connecting links between the Hepaticæ of his tribe *Muscöideæ* and the *Confervine algæ*. Their affinities, however, are perhaps more complex; for notwithstanding, by their evascular axis, they are systematically connected with the mosses, their submersed habits and the internal structure of their stems, bring them close to the Confervales: while their leafless verticillate branches must be considered adumbrations of the equisetine ferns. With this view of their three-fold alliance they are here placed next to the most decidedly axial mosses, and on the confines of the classes leading to the order Equisetales of the Ferns; not, however, as an example of a lineally progressive rise in organization, but as a proof, by their connexion with the Algæ, that no such linear series naturally exist: for the various groups of plants resemble rather the geographical distribution of a country, where each district is bounded by several others, than the successive windings of a majestic stream, which at one part of its course may be named the *Isis*, and at another may be called the *Thames*. Thus, although the simply tubular structure of Nitella reminds the botanist of the simplest confervaceæ, the regularly whorled branches and the decided axis both of this plant

* A tribe containing the Lichens, Fungi, and Algæ.

and of Chara, bring them towards the Equisetaceæ, or horsetail ferns, while their double fructification and still cellular structure, shew their affinity to the mosses, and justify their association with them.

(788.) The Charales are leafless plants; by which circumstance, as well as by their whorled branches, they are distinguished from the *Bryales* and *Hepaticales:* and there are no other orders with which they can be confounded.

(789.) The fructification of the stoneworts consists of organs called *nucules* and *globules* [§ 786, B; *a*, *b*]; the first, formed externally of five spiral valves, terminating in five points, (an unusual number among cellular plants,) and containing one large sporule; the tegument of the *globule* is formed of numerous scales fitted to each other, and it contains many elastic filaments. Walroth says that the globules will germinate; and that they, as well as the contents of the nucules, will propagate the plants.

CHARINÆ.

(790.) CHARACEÆ. It is not improbable that other plants will hereafter be discovered which will connect the Charas already known more closely with the contingent groups to which at present they shew a somewhat distant relationship. If so, other types and sections may be included in the order; but, at present, *Chara* and *Nitella*, which were once combined in a single genus, form, together, the solitary type *Characeæ*, the only one in the section *Charinæ* which stands alone in the order *Charales*. The characters therefore of the order, section, and type, are all the same, viz. a distinct stem, or general axis of growth, with whorled processes resembling branches, destitute of leaves, but bearing minute bristly projections, which may be considered an abortive foliage, or rudiments of leaves. They are therefore separately named only in obedience to the supremacy of system, and for the purpose of rendering the distribution of this class consonant with that of others.

(791.) The genera *Chara* and *Nitella*, once united, are distinguished from each other by the stem and branches of the latter being formed of single tubils [§ 786, fig. E, F, G], while those of the former consist of many, [§ 788, fig. A, B]. The various species of both genera are found in the sea, in salt-marshes, and in fresh water. The *Charæ* are subject to a peculiar calcareous incrustation of their stems, (whence their name, stoneworts;) from this incrustation the Nitellæ are for the most part free.

(792.) The quantity of carbonate of lime which is deposited by vital agency within these plants is very great; indeed, so great, that the entire form of the plant remains after all the organic membranes have been removed. The ditches and ponds in which they grow are also often seen to have strata of considerable thickness formed at their bottoms, merely by these plants, and the chalk that they elaborate or collect. Among the fens in Cambridgeshire, the *Characeæ* are adding, year by year, earthy matter in abundance, to solidify and elevate the low and swampy soil.

(793.) The most interesting circumstance connected with the Characeæ is, that, owing to the extreme tenuity and transparency of their teguments, aided by their sap, containing numerous small opaque masses of Globuline, the motions of their fluids can be ocularly demonstrated, and, by the aid of a microscope, their course be satisfactorily traced. These motions have lately been shewn in a great number of other plants; but the Characeæ are interesting, not only from being the first in which they were clearly seen, but also from the phenomenon being the most easily exhibited in them.

(794.) The figures B, C, F, and G [§ 786], are magnified views taken from the drawings of Messrs. Varley and Slack, in which the courses of the currents round the cellules are shewn by the direction of the arrows. The currents in the different cells or tubils, although no communication exists between them, are continued in the same line throughout the branch or the entire plant. The ascending current in the branches is always farthest from the stem or general axis, the descending one nearest to it. In the Nitellæ these motions can be seen with a lens of $\frac{1}{15}$ inch focus without any previous preparation: in the Charæ, the calcareous incrustations, of course, most be removed.

(795.) The *Characeæ* have a peculiar and disagreeable smell, but very little taste: none of them are known to be noxious, neither are any medicinally or dietetically employed. Hence it is evident that they are not the plants to which Cæsar refers under the name of Charæ, for they afforded *eatable roots*, upon which, in a period of scarcity, the Roman soldiers fed.

These roots, the historian says, were eaten either mixed with milk, or made into a kind of bread. During the civil war, they at one time very greatly relieved Cæsar's forces, which, he writes, were in Spain much straitened in their supplies of ordinary provisions; and, when Pompey's soldiers exultingly spoke of famine,

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those of Cæsar, as a practical denial of their distress, frequently threw loaves of Chara-bread among the enemy's ranks. (*De Bello Civili*, l. iii. c. 40.)

(796.) The three orders CHARALES, BRYALES, and HEPATICALES, form, collectively, the class *Musci.* They are associated by the evolution of leaves or branches on a distinct stem or axis; and by these associating characters they are distinguished from the Fungi and the Algæ, to which, by their cellular structure, they are otherwise allied.

(797.) The class being small, one table will suffice to give a summary of the types and sections included in its several orders.

Class.	Orders.	Sections.	Types.
MUSCI.	Charales	Charinæ	*Characeæ*
	Bryales	Phascinæ	*Phascaceæ*
		Bryacinæ	*Sphagnaceæ* *Splachnaceæ* *Bryaceæ*
		Andræsinæ	*Andræaceæ*
	Hepaticales	Hepaticinæ	*Marchantiaceæ* *Targionaceæ* *Ricciaceæ.*

(798.) Attempts have been made, and not without success, to reduce the successive developments just described, as marking the several sections and orders of this class, to the laws which regulate the evolution of special organs in higher grades. Morphologically considered, the thallöid frond of Riccia is a dilated axis, and the immersed thecæ, sessile fruit buried by the coalescing sub-latent foliage. In the Targionaceæ, the partial axis or fruit-stalk becomes lengthened and distinct, but the foliage is still combined with the stem or general axis. In the Marchantiaceæ, the shoots become more and more divided into lobes; and buds are formed upon the dilated stems within processes of the foliaceous stalk of Marchantia, which are called *origomes, i.e.* within the axillæ of whorls of leaves, as they are in Jungermanniæ in the axillæ of normal leaves. The dehiscence of the urns or thecæ, shew at once their foliar structure; and perhaps the eight-valved urn of Marchantia, the four-valved of Jungermannia, the two-valved of Anthoceros, and the one-valved Monoclea, indicate by their constant separation into the same number of parts, the number of leaves of which they are composed; and the transition from ordinary leaves to valves, is marked by the modified foliage which forms the perichetia, or calycels, and calyptra: the perichetia being only a whorl of leaves more or less developed, and sometimes, as in Riccia, latent or abortive; the Calyptra is another whorl, at first coalescent by their edges and apices, and forming a covering for the urn. Through this covering the urns of Riccia never protrude; those of Jungermannia, as their pedicles lengthen, burst through the slight canopy which continues to surround the base of the thecapode, forming an inferior calyptra.

(799.) The structure of the Bryales may be understood in a similar manner;

but the fruit is here something more complex. The *Perichætium* and *Calyptra* are, as in the liverworts, to be considered as modified leaves; but here the calyptra leaves are so firmly united that the urn, when raised by the growth of the thecapode, instead of bursting through the calyptra, rends the organ from its base, and carries it upwards, still as a cover for the fruit, while the small portions which remain below form a ring or slight sheath, called the vaginule.

(800.) The foliaceous origin of the opercula and the entire urns will scarcely be denied, if the pertinency of the foregoing remarks on the thecæ of Jungermannia be allowed, and especially if the valvular dehiscence of Andræa be borne in mind. The urn, as Lindley observes, should be considered more analogous to a flower than a capsule; it is analogous to the fruit in the rose, which contains the seeds, as it does the spores, and the one is surrounded at the margin with calyx and corolla, as the other is by a single or a double peristome. The sporules of the mosses are, however, only equivalent to naked seeds; and hence the columella must be the continuation of the common axis. Indeed, the sporules are probably buds developed by the columella, as gemmæ are developed in the axillæ of leaves on the lower part of the common axis.

In the Charales a marked change occurs. The axis is more decidedly developed, branches are given off in whorls, and the foliage is abortive, or rudiments of leaves alone appear in the form of hairs. But the nucules and globules, like the urns or thecæ, are formed of valves, which may be considered whorls of leaves. Too little is, however, known of the fruit of these plants, to permit the analogy in all parts to be clearly traced.

(801.) The arithmetical progression previously adverted to, when demonstrating the structure of the Algæ, is quite as evident among the mosses as among the flags: *e. g. Monoclea* has a one-valved, *Anthoceros* a two-valved, and *Jungermannia* a four-valved theca. Tetraphis has a four-toothed, Splachnum an eight-toothed, and Encalypta a sixteen-toothed peristome. In Grimmia, the peristome consists of sixteen equidistant teeth, entire, perforated or cleft, which leads to Didymodon, which has a peristome of sixteen double teeth, *i. e.* teeth cleft, but united at the base and arranged in pairs; and that conducts to Trichostomum, which has sixteen double teeth, cleft to the base. In *Funaria*, where the peristome is double, both the outer and the inner have each sixteen teeth. In Hypnum, Bryum, and Hookeria, the outer has sixteen teeth, the inner consists of a membrane incised into sixteen segments. In Bartramia the segments are thirty-two, or rather, there are sixteen that are bifid. In Orthotrichum, when ciliary processes are present, they are either eight or sixteen in number. In Fontinalis, Neckera, and Anomodon, they are sixteen likewise, the outer peristome having sixteen also; and in Polytrichum the teeth of the outer peristome amount to sixty-four: whence indeed its name, alluding to their number.

(802.) In the Bryales, it will have been observed that not only an arithmetical progression prevails, which is common to them with many other plants, and that the prevalent numbers are multiples of each other, but that they are ruled by a power of four. Tetraphis has four teeth to its peristome, which is the smallest number of divisions in any known moss. The numbers in other mosses are eight, sixteen, thirty-two, sixty-four, and there are no intermediate ones; which is not the case with the urn-valves of the liverworts, nor with the numbers noticed in the Algæ and the Fungi. Throughout all the three classes of this region, the

number two and its multiples prevail; but in the Bryal mosses alone is it a power of four.

(803.) Less attention has been lately paid to these numbers in the organic world than their regularity would seem to demand. Future examples, to be given in the other classes in which three and five are the numerical elements, will prove that they are not merely curious coincidences. But, as it would be premature to draw on these for illustrations now, reference may be made to the acknowledged importance of numerical or definite proportions in modern chemistry. Astronomy also affords many curious proofs of its importance; for it long since marked out the orbits in which the new planets Juno, Pallas, Vesta, and Ceres, then unknown, have lately been discovered to revolve; and it even now foretells the discovery of other satellites to Jupiter, and traces the very paths in which they will be found to move. The one prediction has been verified, the other waits to be fulfilled.

(804.) With respect to their direct utility to man, or in ministering immediately to his wants, it is evident, from the previous observations, that mosses do but little, unless, with the excellent Lightfoot, we admit among the *direct utilities*, that entertainment and agreeable instruction they afford to the contemplative mind of the naturalist, at a season when few other plants offer themselves to his notice.

For, as Johnston well observes, it is most curious to notice how gay these little mosses are on every wall-top during the winter months and in early spring, almost, or perhaps the only things which seem to enjoy the clouds and storms of the season. They choose the most exposed situations, spread out their leaves, and push up their glossy capsules amid rains, frost, and snow, and yet there is nothing in their tender and loose structure, from which we could *a priori* infer their capability of resisting influences so generally destructive to vegetation. But so it is: the more simple the organization of plants, the stronger is their tenacity of life; and its phenomena are exhibited and called into play by stimulants, not only very feeble, but apparently the very reverse of those necessary to excite plants of a higher order. Thus, mosses and lichens, overstimulated by heat and dryness, wither away in summer, but vegetate freely at a season when there is no other vegetation, and when their humble fronds cannot be overshadowed by a ranker growth.

Or, to quote the words of Linnæus, of which the preceding may be esteemed almost a paraphrase:

"Cum omnia circa nos torpescunt, et languescunt, cum flumina rigent, nemora silent, campi latent nivibus obtecti, ubique luctus, rerum facies decolor et tristis mortis imago: Musci inter vegetationis ruinas emergentes et sericeo colore fulgentes, rupes et lapides obducunt."

(805.) It is true that, were we not so abundantly provided with not only the necessaries, but also the luxuries of life, mosses might be applied to a variety of economical purposes, some few of which have already been adverted to. But although, from our wants being otherwise supplied, we make little use of mosses, it must not be

forgotten that, in the general economy of nature, and in ministering remotely to our advantage, few plants are of more real and absolute importance. Even shortly to enumerate the whole of the indirect utilities of these plants, would be an arduous task; let therefore a slight reference to a few alone suffice.

(806.) Mosses gradually fill up and consolidate bogs, and form rich vegetable mould for the growth of larger plants, which they also protect from cold during the winter. Mosses likewise clothe the sides of lofty hills and mountain-ranges, and by their filamentous structure very powerfully condense the watery vapours floating in the atmosphere, and thus become the living fountains of many streams. These plants, and their immediate allies, the liverworts, which often appear to have so suddenly clothed a barren heath, or overspread a dry wall with verdure, have the peculiar property of remaining in a dormant state for a very considerable length of time, and to revive from their parched condition as if awaked from sleep, on the access of moisture, to all their pristine beauty, spreading abroad their delicate leaf-like expansions and their beautiful apologies for blossoms.

(807.) In elegance and delicacy of structure, mosses are not exceeded by any plants that grow; and an intimate examination of these minute vegetables would almost, if not altogether, lead the observer to believe that, however admirable nature may be in every particular, yet that, in excess of modesty, she veils her chief beauties from the vulgar gaze, and reveals them to those true lovers alone who are strictly wedded to her service and her study. Perhaps a higher tribute to their beauty was never paid than that which springs from the detail Mungo Park has given, of the consolation and encouragement he received, in a period of great difficulty and danger, from the contemplation of the inimitable structure of one of these lowly mosses. As an illustration of the wholesome effect of the study of the works of nature on a well-regulated mind, the passage, although often quoted, cannot be deemed unworthy of repetition. This enterprising traveller, during one of his journeys into the interior of Africa, was cruelly stripped and robbed of all that he possessed by banditti. In this forlorn, and all but hopeless condition, he says, when the robbers had left him, "I sat for sometime looking around me with amazement and terror. Whichever way I turned, nothing appeared but danger and difficulty. I found myself in the midst of a vast wildnerness, in the depth of the rainy season, *naked* and *alone*, surrounded by savage animals, and men still more savage. I was five hundred miles from any European settlement. All these circumstances crowded at once upon my recollection; and I confess that my spirits began to fail me. I considered my fate as certain, and that I had no alternative but to lie down and perish. The influence of religion, however, aided and supported me. I reflected that no human prudence or foresight could possibly have averted my present sufferings. I was indeed a stranger in a strange land, yet I was still under the protecting eye of that Providence who has condescended to call himself the stranger's friend. At this moment, painful as my reflections were, the extraordinary beauty of a small moss irresistibly caught my eye, (I mention this, to shew from what trifling circumstances the mind will sometimes derive consolation;) and, though the whole plant was not larger than the top of one of my fingers, I could not contemplate the delicate conformation of its roots, leaves, and fruit, without admiration. Can

that Being (thought I) who planted, watered, and brought to perfection, in this obscure part of the world, a thing which appears of so small importance, look with unconcern upon the situation and sufferings of creatures formed after his own image? Surely not. Reflections like these would not allow me to despair. I started up; and, disregarding both hunger and fatigue, travelled forwards, assured that relief was at hand, and was not disappointed:"

—— "Thus, to apprehend,
Draws us a profit from all things we see."

GEOGRAPHICAL DISTRIBUTION OF THE MUSCI.

(808.) Mosses are very widely spread over the surface of the globe. The earth shoots them forth in almost every variety of situation; and, so that the locality be moist, or occasional access can be had to moisture, scarcely any other circumstance seems essential to the growth of these humble, beautiful, and useful plants. For, as they in general absorb their nourishment chiefly from the atmosphere, soil is to them of little comparative importance; and many appear reckless both of heat and cold. They are found at the lowest depths of vallies, and are met with on the highest alps. They extend even from the confines of perpetual snow to the burning sands of the torrid zone.

(809.) But the three orders into which the mosses have been distributed exhibit very different powers of resisting and enduring atmospheric vicissitudes; and gradually change a watery for an aerial station.

(810.) The *Charales*, although geographically distributed to the full extent of the other orders, are, in their topography, much more restrained. They are essentially water-plants, and always grow submerged. They are most abundant in temperate countries; but, like many other aquatic tribes, are very widely spread, occurring both in salt and fresh water: sometimes in rivers, but more frequently in stagnant ditches, pools, and lakes, in almost every part of Europe, Asia, Africa, Australia, and both Americas.

(811.) The *Liverworts* equal the other mosses in the nominal extent of their geographical range, being natives of every quarter of the globe: but though not all, nor wholly, aquatic plants, they are intolerant of extreme aridity. Hence in Africa very few are met with, while in damp shady places, whether in hot or cold climates, they are abundant; they are, however, the most numerous in temperate regions. The Ricciæ are part of them aquatic, and part of them terrestrial plants.

(812.) The Bryales are chiefly aerial plants; and in them the third station becomes established, for they will endure extremes of dryness which would exterminate most other plants. In newly formed countries, where soil can scarcely be said to be, these mosses, the *servi* of Linnæus, are found labouring in legions; amidst the scoriæ of volcanoes they rear the standard of vitality, and cover the strata of cinders with a coat of vegetation. They are most numerous in moist and temperate countries, but they are spread from the equator almost to the poles. They are among those plants which, as they will endure extremes of heat, are also the last that yield to the rigours of perpetual winter: for we learn that, even in New South Shetland, "the black and lifeless soil is covered with specks of mosses struggling for existence," and that they are plentiful on the otherwise barren rocks of Spitzbergen.

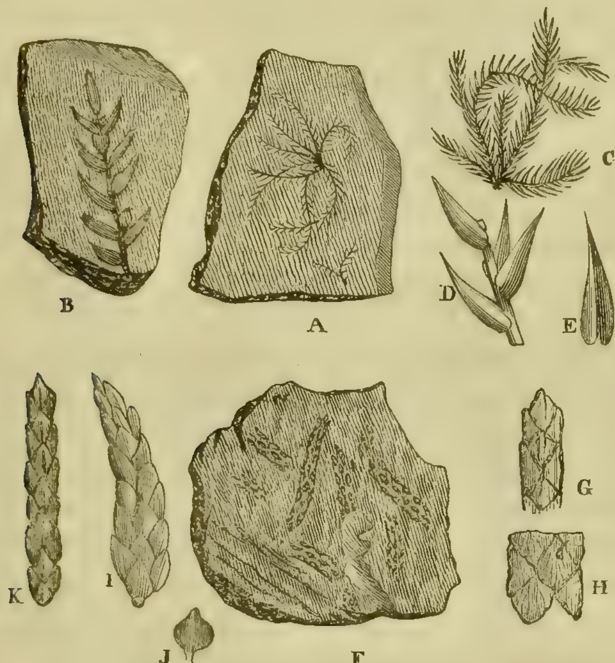
(813.) Of the geographical distribution of the different types and sections of this order little can be at present said; for, although many of the 970 known species appear to be proper to particular climates, while others seem to be cosmopolites, still the established facts are as yet too few to justify any sweeping generalizations.

(814.) The numerous species of Hypnum, the most extensive genus in the class, are so very abundant and so generally dispersed, that a botanist of repute believes it would be "no exaggeration to say, that they form *a fourth part* of the vegetable clothing of this island. They are met with everywhere. In many old pastures they usurp the place of the more useful grasses: they form a large proportion of the vegetation of moors: they flourish at hedge-bottoms, in woods and deans, on rocks, and even on sand-links; and they grow in profusion in every marsh, and bog, and stream. The share they thus contribute to the green covering of earth is very considerable; especially in winter, when they are in their greatest perfection," and when they are the most wanted, not for ornament alone, but for the protection of other plants, and the preservation of myriads of insects which otherwise might perish. Whether or not Johnson's data fully warrant the conclusion he has ventured to draw with regard to the proportion of these mosses in this country, it is well known that Musci form upwards of a fourth part of the entire flora of Melville Island, and probably of many other places similarly circumstanced.

(815.) The minute sporules which constitute the seeds of mosses can alone account for their universal distribution, and their constant presence even on the most distant and most barren spots. Bare rocks raised from the bosom of the sea, torrents of lava which convert fruitful fields into barren wastes, bogs, marshes, and mountain-tops, are all covered by mosses, and their allies and fellow-labourers, the lichens, because there they most are wanted, and there they work to the most advantage.

GEOLOGICAL DISTRIBUTION OF THE MUSCI.

(816.) Five fossil species of Chara, and one, or at the most two, fossil mosses, are all that have been as yet discovered. No vestige of a fossil liverwort has hitherto been found. It is true, as



A. Muscites Tournalii, reduced. B. Portion magnified. C. Hypnum riparium. D. Portion magnified. E. Leaf separated. F. Muscites (?) squamatus. G, H. Portions magnified. I. Sphagnum compactum. J. Separated leaf of ditto. K. Branch of Juniperus phœnicea.

Brongniart observes, that Daubenton believed he had recognised a variety of these plants in the moss-like markings of Agate; and Mr. M'Culloch published, in the Geological Transactions, several figures having a very strong resemblance to Jungermanniæ. But Brongniart, after much laborious investigation, concludes that they are simply infiltrations, accidentally assuming forms which, without very attentive examination, might be mistaken for vegetable impressions.

(817.) That the stoneworts should be found in a fossil state from the first epoch of their existence, might be presumed from the dense incrustation with which they surround themselves; petrifaction being to them a natural process, that terminates their life. But, although abundant in the beds above the chalk, their first appearance is in the lower fresh-water formation. The fossil

nucules of the Chara, [§ 786, K, L,] were called by Lamarck *Gyrogonites;* but later naturalists considering the fossils to be remains of plants identical with those now existing, they of course must have the same denomination. The stems and fruit of fossil Charæ are very common in this country; and beautiful specimens are procured from the Scotch marl, and from the lakes in Forfarshire, where they are most abundant.

(818.) Of the two species of Muscites, one only is absolutely decided to be a fossil moss; the other, which at first was thought to be a Lycopodium, although now called a Muscites by Brongniart, has a query attached to its generic name.

The Muscites squamatus, [fig. E, G, H,] has long been known under the name of Lycopodites, as occurring in the mill-stone quarries near Paris.

The Muscites Tournalii, [fig. A, B,] has been but lately discovered by M. Tournal, near Narbonne, in a fresh-water formation, consisting of chalk marl, and forming part of the tertiary series.

The former, Brongniart considers to bear a stronger likeness to the Hypnidæ than to any other mosses, and he gives a figure of *H. riparium*, [fig. C, D, E,] to shew the similitude of the leaves; at the same time pointing out various other resemblances to other species, such as *H. ripariöides, cuspidatum, denticulatum*, and *elegans.* The latter more doubtful fossil he likens to the *Sphagna*, some of the fragments bearing the greatest resemblance to *S. compactum*, [fig. I, J,] and others to *S. squarrosum.* The regularity of the four ranks in which the leaves of the Junipers are arranged, [fig. K,] will at once separate them from these remains, with which otherwise they might be confounded.

(819.) It is a remarkable fact, as Brongniart justly observes, that the most jealous scrutiny has failed to detect the slightest indication of Muscites in the coal formations, though the epoch in which the plants which form those strata lived appears to have been favorable to a vegetation resembling that which is now in many parts of the world accompanied with the growth of mosses. It is indeed most curious, that the earliest traces of any of these plants should occur at so late a geological period, when it is considered that the Charales will grow both in salt and fresh water, that the Bryales require no soil at all, and how tolerant they are of heat and cold.

(820.) The mosses therefore afford another proof of the weakness

of the doctrine of progressive development; for, notwithstanding the simplicity of their structure, their epoch of appearance is long, very long after that of palms, pines, ferns, and other higher vegetables.

(821.) Two different schemes of structure have already been described as being each characteristic of one of the two preceding classes; both of which set out from nearly similar simple beginnings, but pursue, in their developments, quite opposite courses.

(822.) In the Algæ or Flags, the organs of vegetation predominate, and the constant tendency is expansion into leaves or leaf-like members; so that, although true foliage is never formed, even the stems are phyllöid, or foliaceous.

(823.) In the Fungi or Mushrooms the reverse occurs, for the fructification is pre-eminent; the plants sometimes consisting of fruit alone: and no tendency is ever observed towards the production of leaves. On the contrary, the nisus is towards the extension of the plant into an axis or stem, which, in the *Clavariæ*, and some of the higher fungi, is developed in considerable perfection: and, whenever expansions are produced, as in the *pilei* of the Boletales, and especially in the *lamellæ* of the Agarics, they are the very antipodes in resemblance to ordinary leaves; so that the Fungi are peculiarly aphyllous plants, while the Algæ are foliaceous, or rather pseudo-phyllous ones.

(824.) The Musci or mosses, though in very many respects unlike either of the foregoing classes, would seem to be regulated in their evolution by both those powers in a nearly equal degree which were respectively predominant in the Fungi and the Algæ; and, as the result of this compound influence, they combine a regularly developed axis or stem, with ramifications or foliar appendages. The axis and its radial appendages being for the most part distinct, and not blended into an obscure mass, or forming a doubtful organ, which may with equal propriety be considered as either leaf or stem, as both or neither.

(825.) The Mosses, regarded as a series, exhibit some further most beautiful gradations, the structures, the textures, and the members, becoming progressively more and more various, and less and less blended with each other. In Riccia the whole plant is most decidedly a *frond*, but little raised, except in its hue, above the condition of a *thallus;* for the plate or layer of cells, of which the organ of extension is composed, projects from its

under surface radical fibres, and within its upper, conceals the organs of reproduction. From Riccia, which often presents but a simple disc of vegetation, and connects the Liverworts through Endocarpon with the Lichens, the course may be pursued through Marchantia, where the frondose expansions are greatly sinuated and the urns elevated—to the Jungermanniæ, some of which entirely lose the frondose character and assume the *surculus*, which is present in all the Bryales. In the mosses the expanded projections of the axis, which are called leaves, are frequently found conjoined, shewing that the union of the whole would constitute a frond; just as the minute division of the frondose membrane forms the leaves. In the Hepaticæ the cellules are rounded or nearly so, and no such thing as a *rib* is to be seen traversing the expansions, even in the foliose Jungermanniæ, and the rudimentary axis or rachis of the frondose species, is in some abortive. In the *Bryales*, the cellules become more and more elongated, nervures or ribs are formed upon the leaves, and filamentary projections extend beyond the margins, which, being the continuations of the mid-ribs, are called excurrent nerves. In the Charales, the cellules are so much extended that they must be regarded as tubilli, and they mark the transition of cells into tubes, or the change of vesicles into vessels, commonly so called; thus carrying this region to the confines of the next. Indeed, in Sphagnum, and one or two other instances, it is asserted that tubular vessels have been found, as well as fibro-membranous cells, which are the rudiments of spiral tubes; Hooker also discovered in some few cases perforations in the leaves, which have since been shewn by Mirbel to be true *Stomata;* organs which had previously been supposed to be confined to the following classes.

(826.) True Stomata are generally signs of tubular vessels existing within the plants upon which they are found; and, when the development of both is confirmed, a remarkable change occurs, not only in the organic elements of which the plants are composed, but also in their external configurations, external form being most frequently an index to internal structure.

(827.) Upon these important structural peculiarities depends the distribution of the whole vegetable reign or kingdom into the three chief regions, already named, and described, in the Introduction. The Algæ (or *flags*), the Fungi (or *mushrooms*), and the Musci (or *mosses*), using these terms in their familiar and extended acceptations, and including in each class the several orders specified, constitute, collectively, one of these great groups or regions, viz. that which, from the simply cellular structure of the plants it comprehends, has received the

common appellation "CELLULARES," *q. d. Plantæ Cellulosæ*. The anatomical discovery that certain plants are formed of cells alone, while in the tissues of others both tubes and cells are combined, in various manners, has afforded some most important differential signs to the systematic botanist; and one of the chief bonds of union of the three classes associated in this region is their unvaried cellular structure. It is however essential to add, that they are *flowerless* as well as cellular plants; because, in several instances, the tubular vessels become obsolete in genera and species, such as *Nayas*, *Rafflesia*, &c. which are flowering plants, and undoubtedly allied to the tubivascular series. The name *cellulares* thus becomes exceptionable, and the older terms, *Acotyledones*, *Sporiferæ*, &c. are still less admissible.

(828.) Hence, for the above reasons, as well as for those explained in the Introduction, it has been proposed to call these classes, collectively, the *Moss* or *must-allies* (Mycaffines), which is, in reality, little more than the restoration of the derivatives to the original signification of their common roots, [§ 64—66.]

(829.) In the synthetic association of the orders contained in these classes, and the various types and sections they respectively include, it has been attempted to bring together, as far as the present state of science will permit, those plants which are the most nearly allied in structure, and to let the characters of the several groups result from their association. Such was the avowed principle acted on by Linnæus, in the construction of his genera and other natural groups; and such is the only legitimate path to be pursued in the development of the so-called natural methods of arrangement. Hence, as every part is necessarily examined, the details are diffuse; and, as organs vary in their importance in various plants, the differential signs are often changed, sometimes being founded on the fruit, sometimes on the foliage, and at others upon neither.

(830.) But although, for far nobler ends, the natural method sacrifices the simplicity and singleness of an artificial scheme, which is only designed to be an index, it is not wholly destitute of analytic powers; and it is satisfactory to observe, how often the associating characters of the several groups can be made practically useful as differential signs. The following table will illustrate this position; and, though essentially imperfect as an index, from the *chief* characters alone being given, and the exceptions that occur in the osculant groups, still it will not be abused by those who understand the respective values of the natural and artificial schemes; and reference can readily be made to the previous pages for the other characters which could not be condensed into the space of a tabular conspectus. A secondary advantage may also result from such a summary concluding each of the three great divisions of the vegetable world; for it will shew how easily the most important indicative characters of the classes and natural orders may be remembered, and in how few words the chief differences of even the sections and subordinate types may be expressed, when one small page contains the whole.

	Classes.	Orders.
MYCAFFINES. Flowerless cellular plants.	MUSCI. Leafy or branched, axis developed	*Charales*, leafless, branches whorled. (9)
		Bryales, foliose, urns operculate. (8)
		Hepaticales, chiefly frondose, deoperculate. [(7)
	FUNGI. Leafless or aphyllous	*Boletales*, hymenium present. (6)
		Tuberales, h. absent; fungus pouch-like. (5)
		Mucedinales, sporidia naked. (4)
	ALGÆ. Foliaceous or pseudo-phyllous	*Lichenales*, aërial algæ. (3)
		Fucales, aquatic inarticulate algæ. (2)
		Confervales, articulate algæ, chiefly aquatic. (1)

MUSCI.	9.	CHARINÆ.	*Characeæ.*	Axis much developed, branches whorled, leafless.
	8. BRYALES.	PHASCINÆ. Urn indehiscent	*Phascaceæ.*	Operculum persistent, urn indehiscent.
		BRYACINÆ. Operculum deciduous.	*Sphagnaceæ.*	Peristome absent.
			Splachnaceæ.	——— single.
			Bryaceæ.	——— double.
		ANDRÆASINÆ. Urn dehiscent by valves.	*Andræaceæ.*	Opercle persistent, urn dehiscent by valves.
	7.	HEPATICINÆ. De-operculate, chiefly frondose.	*Marchantiaceæ.*	Urns calyptrate, dehiscent.
			Targionaceæ.	Urns veil-less, dehiscent.
			Ricciaceæ.	———, indehiscent.
FUNGI.	6. BOLETALES.	AGARICINÆ. H. distinct, ascigerous, inferior.	*Agaricaceæ.*	H. lamellar, or plicate.
			Boletaceæ.	H. sinuate, porous, or subulate.
			Auriculariaceæ.	H. tuberculate, papillose, or smooth.
		HELVELLINÆ. H. distinct, ascigerous, superior.	*Helvellaceæ.*	H. not marginate, receptacle cap-like, open.
			Pezizaceæ.	H. margined, rec. not cap-like.
			Clavariaceæ.	H. not margined, amphigenous, rec. elongated.
		TREMELLINÆ. H. blended with the receptacle. Asci none.	*Cyphellaceæ.*	H. inferior, rec. dry.
			Exidiaceæ.	H. superior, rec. irregular.
			Tremellaceæ.	H. obscure, amphigenous.
	5. TUBERALES.	TUBERINÆ. Sporidia in proper discrete receptacles.	*Phallaceæ.*	Receptacle discrete, sporidia in a mucous stratum.
			Tuberaceæ.	Sporidia in membranous sporangia.
			Nidulariaceæ.	Sporangia free, peridium discrete.
		BOVISTINÆ. Peridium not discrete, sporangium without a nucleus.	*Bovistaceæ.*	Peridium distinct, figure determinate.
			Spumariaceæ.	Per. spurious, figure indeterminate.
			Sclerotiaceæ.	Per. connate, or confounded with sporangia.
		SPHÆRINÆ. Perithecia nucleiferous.	*Sphæriaceæ.*	Per. ostiolate, nucleus ascigerous, diffluent.
			Phacidiaceæ.	Per. dehiscent, asci discoid, erect, fixed.
			Xylomaceæ.	Per. crowded with sporidia.
	4. MUCEDINALES.	TUBERCULARINÆ. Sporidia simple; receptacle solid and persistent.	*Ceratiaceæ.*	Receptacle floccose, figure various.
			Dermosporiaceæ.	Rec. smooth, subspherical, sporidia incumbent.
			Tuberculariaceæ.	Rec. roundish or flattened, sporidia subdiffluent.
		MUCORINÆ. Sporidia free, fixed upon, or bursting through a simple peridiolum.	*Stilbiaceæ.*	Peridiolum thin, fugacious, stipulate, not discrete.
			Mucoraceæ.	Per. distinct, inflated.
			Acremoniaceæ.	Per. like sporidia, fixed to flocci.
		MUCEDINÆ. Receptacle floccose, sporidia scattered, soon free.	*Botrytiaceæ.*	Flocci of two forms, septate.
			Fusidiaceæ.	Flocci uniform.
		UREDINÆ. Minute parasites, bursting through the cuticle of the plants bearing them.	*Sporodesmiaceæ.*	Stroma genuine.
			Nemasporaceæ.	Str. spurious; growing on dead plants.
			Uredinaceæ.	Str. none; chiefly on living plants.
ALGÆ.	3. LICHENALES.	BYSSINÆ. Thallus filamentary, fructification uniform.	*Byssöidaceæ.*	Spores and sporidia obsolete.
			Byssaceæ.	Flocci free or subdiscrete.
			Rhizomorphaceæ.	Flocci concrete.
		VERRUCARINÆ. Apothecia closed and nucleiferous.	*Verrucariaceæ.*	Thallus crustaceous, excipuli proper.
			Pertusariaceæ.	Excipuli thallöid.
		CETRARINÆ. Apothecia open, disciferous.	*Graphidaceæ.*	Excipuli when present, proper.
			Parmeliaceæ.	Excipuli thallöid.
	2. FUCALES.	FUCINÆ. Fronds more or less densely fibrous, nigrescent, sporidia dark or black; all marine.	*Lichinaceæ.*	Frond dense, conceptacles porous.
			Fucaceæ.	Fr. fibrocellular, olive green, becoming black on drying.
			Laminaceæ.	Fr. dense, hue little changing.
			Sporochnaceæ.	Fr. tufted, dark, not very variable.
			Chordariaceæ.	Fr. solid, threadlike, round.
			Dictyotaceæ.	Fr. reticulate, mostly ribless.
		FLORINÆ. Fronds membranous, or cartilaginous, colour brilliant, little changing; sporidia purple: all marine.	*Furcellaceæ.*	Fr. not fibrous, sporidia pyriform.
			Spongiocarpaceæ.	Sporidia wedge-shaped, sori spongy, wart-like.
			Floraceæ.	Frond leafy, hues brilliant, little changing, spores sorate or ternate.
			Gastrocarpaceæ.	Fr. ribless, veinless, gelatinous within.
			Caulerpaceæ.	Fr. green, membranaceous, creeping.
			Thaumasiaceæ.	Fr. reticulate, ribs rigid, fragile.
		ULVINÆ. Sporidia colourless or green, fronds mostly membranous. Fresh-water, sea, damp soil.	*Lemaniaceæ.*	Fr. coriaceous, fruit internal.
			Ulvaceæ.	Fr. membraneous, fruit internal.
			Siphonaceæ.	——— ———, fruit external.
	1. CONFERVALES.	CONFERVINÆ. Articulations within a tubular thallus.	*Ceramiaceæ.*	Fruit external.
			Confervaceæ.	——— internal (endochrome) th. not gelatinous.
			Oscillaceæ.	Fr. internal in masses septate, th. subgelatinous.
		NOSTOCHINÆ. Thallus jelly-like, form definite, not fragile.	*Rivulariaceæ.*	Thallus globose often filiform, fil. annulate.
			Nostochaceæ.	Thall. globose, cells dispersed, or moniliform.
		FRAGILLINÆ. Thallus absent or obscure, plants very fragile.	*Fragillaceæ.*	Cells for a time connected, fragile.
			Globulinaceæ.	Cells soon disarticulating.

OUTLINES OF FILICOLOGIA.

(831.) The *Club-mosses* or *Foliose-ferns*, [§ 68, E, F, § 840, 843, 847,] (SELAGINALES;) the *Brakes* or *Frondose-ferns*, [§ 68, A, B, C, § 852, 859, 863, 881,] (PTERIDALES;) and the *Shave-grasses* or *Leafless-ferns*, [§ 68, D, § B,] (EQUISETALES,) form, with their respectives allies, three natural orders, which, by being tubivascular flowerless plants, are associated in a common group, or class, denominated FILICES or FERNS. [§ 68.]

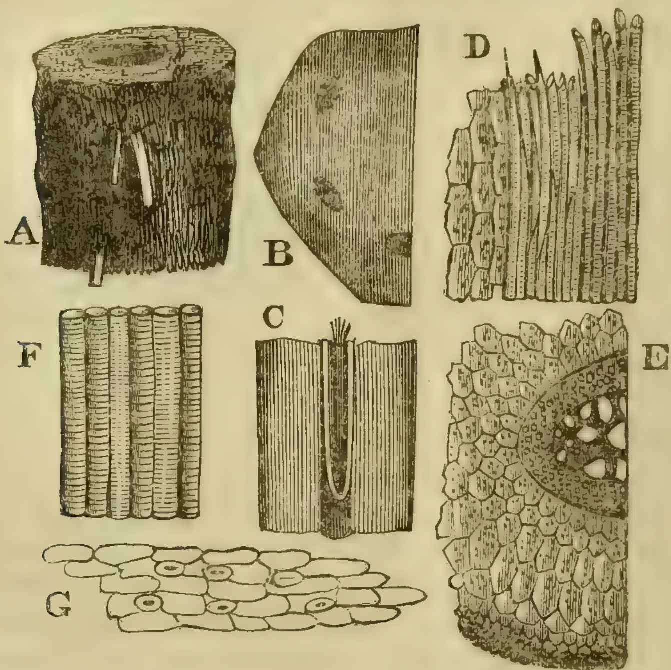
(832.) It is more than probable that the Greek synonyme *Pterides*, [from πτερον, a wing,] was given originally to only one of these orders, viz. the Brakes or Frondose-ferns, which have winged fronds as a common character; and that the Latin *Filices* [from *filum*, a thread,] belongs of right to the filamentous shave-grass ferns alone. But usage has made both terms synonymous, and applied them, oftentimes indifferently, to every order. Sometimes, however, they have been confined exclusively to the Brakes or wing-like ferns; and at others they have been made into distinct appellations, by various prefixes and suffixes, while the simple words have been regarded as common collective terms. Thus the Club-mosses have been called *Rhizo*pterides or *Bryo*pterides, root or moss ferns; the Brakes, *Phyllo*pterides, foliaceous or frondose ferns; and the Shave-grasses *Stachyo*pterides or *Gonyo*pterides, *i. e.* spiked or jointed ferns.

But neither these nor other similar words and phrases, such as *Filices Spicatæ*, *Dorsiferæ*, *Epiphyllospermæ*, &c., have been generally adopted; and *Equisetum*, *Pteris*, and *Selago*, old and well-known names, which are still retained by some of the most common and familiar examples of the several groups, afford perhaps preferable denominations.

(833.) The ferns are tubivascular flowerless plants; and the latter part of this definition at once distinguishes them from the other classes with which, by the former, they are allied. Because they are cryptogamic, some persons would regard them as evascular, and notwithstanding their structural peculiarities and their palm-like port would associate them with the mosses, the fungi, and the algæ; but such an arrangement anatomical investigations absolutely forbid.

(834.) In the first place, the tegument of these plants differs widely from that

of either of the previous classes, by being furnished with distinct and regular openings, called *mouths* or *stomata*, which are characteristic of a true cuticle;



A. Transverse section of the stem of an arboreous fern, showing the hollow centre, and the coating of adventitious radicles. B. Aspidium Filix mas. Transverse section of half the petiole to show the fascicles of fibres and tubes, surrounded by minutely cellular substance. C. Longitudinal section of one of the fascicles. D. Small portion very highly magnified, to show the annulate structure of the tubes. E. Small portion of the section B much magnified, to show the cellular structure and transverse sections of the tubes forming the fascicles. F. Annulate tubes from the stalk of Lycopodium denticulatum. G. Portion of the cuticle of the same plant, showing its areolations and stomata.

a texture not to be found in the mosses, flags, or fungi, their tegument, when any is evolved, being simply an *ep-enchyme*, or condensation of cells similar to those beneath it, and seldom possessing stomata.

(835.) In the second place, a transverse section of any of these plants will shew that their internal structure is as different from the internal structure of the previous classes as the *cuticle* that invests it is from the parenchyme; for, instead of the simple homogeneous cellular substance of the mosses, flags, and fungi, there is found among the cells one or more fascicles of lengthened tubes, [§ 834,B.C.D.E.] formed either of simple membranous tunics, or of longitudinal series of tubils extended into the tubes, and which are ordinarily called vessels, although a cell is a vessel as much as a tube, from which it differs only in its form; and, in the common and proper acceptation of the word, perhaps the cup or cistern which receives the fluid has a better right to the denomination *vessel*, than the tube or pipe through which it passes; for *vas*, *vasculum*, *vasello*, *vaiselle*, mean rather the reservoirs that contain, than the channels that transmit.

(836.) But, provided that the fact of this difference be clearly known and un-

derstood, it matters little whether the continuous channels be called tubes, tubular vessels, or vessels only; although perhaps the latter word had better be used collectively to include both kinds. These tubes, when examined, are found to differ in their structure, being either perforated with many pores, or thickly set with minute corpuscules, constituting the corpusculiferous tubes of Dutrochet, or the perforated vessels of Mirbel. Along with these corpusculiferous tubes other tubes are met with, the structure of which is different; they seeming to consist of a series of coalescing rings, or rather of helices, the successive turns of the spiral threads of which, lying close upon each other, form a tube, which tubes are called spiral tubes, or tracheæ; but when, as in these plants, the turning of the helices are so connected as not to be able to be unrolled, they are called false spirals, or false tracheæ, to distinguish them from those which readily untwist, and which are named tracheæ, or true spirals.

(837.) These plants therefore consist of cellular texture intermixed with tubular vessels, and are covered by cuticle; and tubular vessels never being known to be present without the cuticle being furnished with stomata, leads to the belief that stomata are very rarely present without being accompanied by tubular vessels. Indeed, in almost every plant that has been carefully examined, they have been found to be accompaniments of each other. Some few exceptions are however known. *Marchantia* and *Targiona*, which by their stomata anticipate a character of this succeeding class, and thus strengthen the union of the whole, are two already noticed, [§ 760;] and *Isoetes* (840,) one of the *Selaginales*, is another. But, with regard to this latter, it is not improbable that, if the dissection of its stem and leaves was more accurately performed than opportunity has hitherto allowed it to be, some traces of vessels would be found in them, as the stomata are so highly developed. The tubes would, however, be expected to be in a more rudimentary state than in *Lycopodium*, [834 F.G.] because this genus seems to be but a humble aquatic ally of the Wolf's claw-wort, and nearer the transitional line which runs between the evascular mosses and the tubivascular ferns.

SELAGINALES.

(838.) The *Selago* of the British druids (if indeed the herb which now bears that name be identical with the plant so much prized by them,) was formerly, with its allies, the fox-tail and wolf's-claw worts, from their general resemblance to mosses, considered as such; and hence indeed their common names of *Club-moss*, *Fir-moss*, and *Mountain-moss*.

Modern research has however shewn that, although in the transitional group or district they are essentially different from mosses, both their organs of vegetation and fructification decidedly associate them with ferns. Hence they have been removed from the preceding class, and placed in this; and hence also the Selaginales are now called foliose, moor, or mossy ferns.

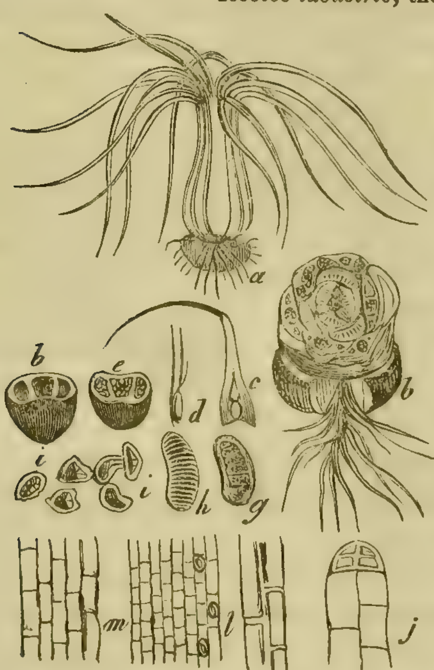
LYCOPODINÆ.

(839.) *Lycopodium*, the wolf-claw wort, and *Isoetes*, the quill wort, are the normal genera which give names to the two types

Lycopodiaceæ and *Isoetaceæ*, which this section comprehends. They are associated and distinguished from the next section by their stems being foliose, and by the spores being contained in axillary thecæ, which are either dehiscent, or, if indehiscent, enclosed within the bases of the leaves. In the *Lycopodiaceæ* the thecæ dehisce by valves; in the *Isoetaceæ* they are enclosed within the bases of the leaves, and are indehiscent. The Lycopodiaceæ have a lengthened axis: in the Isoetaceæ the axis is abortive, and the foliage crowded in radical whorls upon a reduced stem called a *cormus*, [§ 840, *a*, *b*.] They have both the habits and appearance of mosses, while their fructification is decidedly that of ferns.

(840.) Isoetaceæ. In *Isoetes*, the quill-wort, the organs of fructification are small cases, called conceptacles (*conceptacula*), situated in the angles formed by the union of the leaves and the contracted stem (*cormus*:) those in the axillæ of the outer or infe-

Isoetes lacustris, the lake quill-wort.



(*a*) Entire plant, half the natural size.
(*b*) Transverse section near the bases of the leaves, shewing the enclosed organs of fructification.
(*c*) Front view of one of the external leaves, shewing its conceptacle.
(*d*) Side view of the same.
(*c*) Transverse section of the conceptacle, shewing its three cells filled with granules.
(*f*) The same, the granules having been removed.
(*g*) Longitudinal section of one of the inner conceptacles, shewing its numerous cells filled with grains.
(*h*) Ditto, grains removed.
(*i*, *i*) The grains very much magnified.
(*j*) Section of a leaf, shewing its lengthened cells.
(*k*) Another section of the same.
(*l*) Cuticle of the lower surface of the leaf, with stomata.
(*m*) Cuticle of the upper surface.

rior leaves are divided into three cavities, containing about fifty spherical bodies called *granules;* the cases in the axillæ of the internal or superior leaves are divided by numerous transverse partitions into many cavities, which are all of them filled with an impalpably fine powder, in the early stages of its development white, but subsequently becoming black. These conceptacles are enclosed by the bases of the leaves, and are indehiscent; which

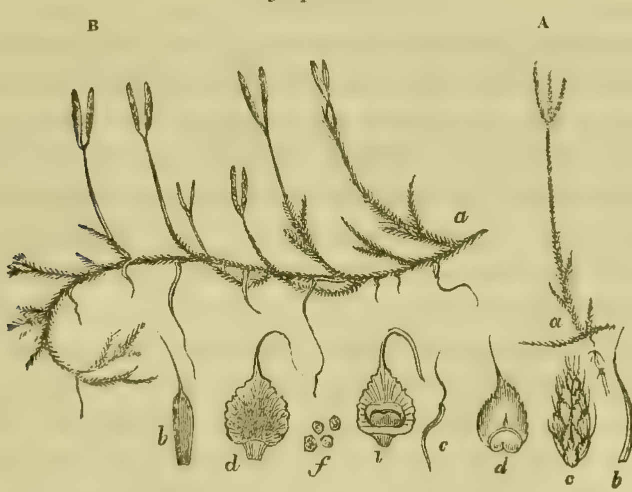
characters will easily distinguish the Isoetaceæ from all other types.

(841.) The name *Isoetes* is derived from ισος and ετος, alluding to the evergreen state of these plants, giving them an *equal* beauty throughout the *year*. They grow at the bottoms of lakes, and are said to afford excellent food for fish. They have been called quill-worts, from the rush or quill-like appearance of the leaves.

(842.) This genus has been commonly associated with several others, to which indeed it has a general affinity, under the name *Hydropterides* or *water ferns*, but from some of them it so decidedly differs, that, although they might well be arranged in the same section, they can scarcely with propriety be kept without further distribution, or be included in the same type. Hence, Bartling removed Isoetes from the Lycopodiaceæ, where it was located by De Candolle, Brongniart, and others, to join it with the pepper-worts (Marsileaceæ), a group to be immediately described, but to which its affinities are not more obvious, if so close; and therefore it had better constitute by itself an intermediate or border type, under the name of Isoetaceæ.

(843.) LYCOPODIACEÆ. The axis, which in Isoetes is contracted into a mass called *cormus*, on which the leaves are thickly set, like the leaves or scales of a *lily*, or other bulb, so as to form a tuft, is, in Lycopodium and its allies, lengthened, and the leaves distributed along its course, which often extends to several feet.

Lycopodium.



A. *Lycopodium selago*. (*a*) Portion of the moss-like frond. (*b*) A leaflet of the fruit stalk separate. (*c*) Apex in fructification. (*d*) Bractea, with conceptacles in the axilla.

B. *Lycopodium clavatum*. (*a*) Trailing moss-like stem. (*b*) A leaflet of the fruit stalk separate. (*c*) A hair-like mucro. (*d*) External side of a bracte. (*e*) Internal surface, with conceptacles in the axilla. (*f*) Granules separate.

The conceptacles or coques are sessile, situated in the axillæ of the leaves, and, as in Isoetes, are of two kinds; the one including larger, the other smaller bodies. The smaller are considered by some as anthers, or pollen cases, and contain a fine yellowish dust called pollen; the larger corpuscles are alone believed to germinate, and to be the true *granules*. The anther conceptacles open by two, and the granule conceptacles by four valves.

The granules, when examined, do not exhibit within them any very perceptible traces of distinct organs, such as a rudimentary stem or radicle; although, by some botanists, the two small leaves which they first form have been named cotyledons; and Brotero describes a little oily body within the granule as a *vitellus*, but De Candolle rather considers it to be a cotyledon. These parts are however too obscure, and have been too little examined, to allow them at present the names which belong to much more highly developed organs: they would seem to be rather precursors of the cotyledons, anthers, &c., than really such, just as the flattened caudal extremities of the Cetacea and the Seals are rather transitions towards legs, than really feet.

(844.) The *Lycopodiaceæ* comprehend only two, or at the most three, well-marked genera, viz. *Lycopodium* [§ 68, E, F; § 843,] the wolf-claw-wort, *Psilotum* [§ 847, A,] or *Bernhardia*, the naked moss-fern, and *Tmesipteris*, the cut-fern. The two last-named are objects of interest here, rather from their rarity than their beauty: the former, in many of its species, is extremely common on many of our upland heaths and alpine moors. The Selago (Lycopodium selago) was once famed as a powerful remedy in diseases of the eyes, whence indeed, according to De Theis, it received its name, which is derived from the Celtic SEL, *sight*, and JACH, *salutary*. It is even now, in the Highlands of Scotland, made into an irritating ointment, which is applied with advantage to the neighbourhood of the eyes as a counter-irritant. This unguent is also employed to dress foul ulcers, and might be used for keeping blisters open instead of savin. Internally administered, the selago acts violently as an emetic and cathartic. The Highlanders, we are told, notwithstanding, give it in infusion; but, if the dose is not very small, it is followed by serious giddiness and convulsions. Linnæus says, the Swedes find a decoction of this herb serviceable as a detergent lotion, and in destroying the vermin that often infest swine and other animals; the Poles also state, that a decoction of another species, the *L. clavatum*, [843, B,] is more successful than any other means yet known in the treatment of that dreadful disease *Plica polonica*. Both the species just named, as well as the *L. complanatum*, &c., are used in various places instead of alum, to fix the colours of certain dye-stuffs; with Brazil-wood, they form a beautiful and permanent blue. The *Pollen* or *granules* of *L. clavatum* are

collected in large quantities, and known in the market as vegetable sulphur. This dust is used for the purpose of ameliorating wine. It is also employed as an absorbing powder, to prevent excoriations in young children; but its chief consumption is in pyrotechny, for the utter impalpability of the powder causes it, when set fire to, at once to be consumed; hence it is in great request at theatres, for the purpose of producing artificial lightning.

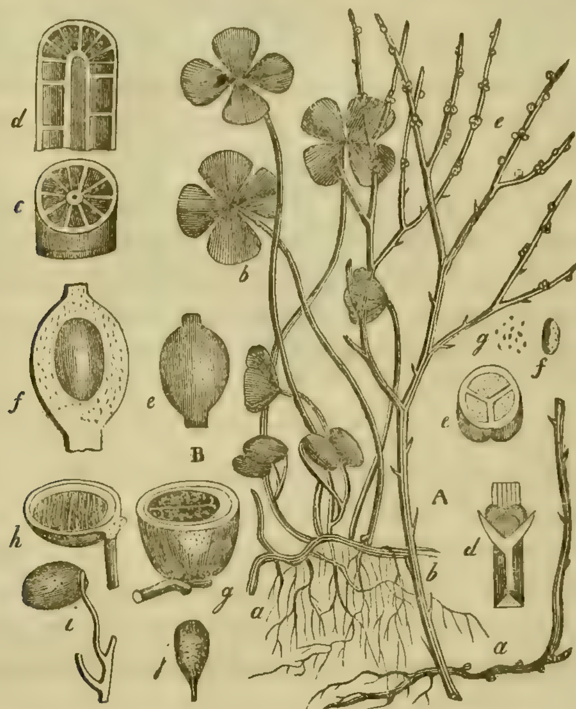
(845.) The two types now illustrated, viz. the *Isoetaceæ* and *Lycopodiaceæ*, form, together, the section *Lycopodinæ*, which, as the best known, has been the first described, although perhaps not the lowest of the moss-ferns, the Pepper-worts having more the structure of the Hepaticæ than these of the *Bryales*.

MARSILINÆ.

(846.) *Isoetes*, which by some Filicologists is associated with the present rather than the preceding section, marks the transition from the one to the other, and connects the two. The chief distinctive characters of this section are, that, in both the types, the conceptacles are free and indehiscent; for in the Lycopodinæ, when free, they are not indehiscent, and when indehiscent, they are not free.

(847.) MARSILEACEÆ. The *Pill-wort* (*Pilularia*), with its congener (Marsilea,) the pepper-wort, are associated in a type named MARSILEACEÆ, and known by their free conceptacles being sessile in the axillæ of their leaves, like the *Lycopodiaceæ*, and not enclosed in the bases of the petioles, like *Isoetaceæ;* from both of which they are, however, further distinguished by their uniform fructification and circinate vernation. The conceptacles are of one kind only; they are seated in the axillæ of the leaves, which are scattered along a lengthened prostrate stem; they are indehiscent, and contain at the upper part of their cavities sessile corpuscules, which are considered analogous to anthers, as they emit a yellow dust or pollen; and below these, in the same conceptacle, are other sessile but larger corpuscules, which have been called pistils, each crowned with a minute point, which has been named the stigma. Each of these corpuscules becomes a monospermous or one-grained fruit, which, during germination, protrudes first a radicle and then a leaf, which are subsequently increased into a tuft of each, the first leaf being considered by some persons to be a cotyledon; of which organ it is probably a repre-

sentative or proxy. The granules contained in the conceptacles of Pilularia and Marsilea are of two kinds, being analogous to the



A. *Psilotum triquetrum*. (*a*) Root. (*b*) Stem and branches. (*c*) Fructification. (*d*) Section of stem with leaves and axillary fruit. (*e*) Horizontal section of the fruit. (*f*, *g*) The granules magnified, and of the natural size.

B. *Marsilea quadrifolia*. (*a*) Rootlets. (*b*) Leaves. (*c*) Section of pedicle. (*d*) Longitudinal section of the same. (*e*) Fruit. (*f*) Ditto, with part of the tegument removed, to shew the reproductive body. (*g*) Transverse section of a conceptacle, to shew the two sorts of contained granules. (*h*) Conceptacle cut lengthwise. (*i*) Stalk, bearing a conceptacle. (*j*) One of the granules supposed to be a stamen.

larger and smaller granules found in the separate conceptacles of *Isoetes:* the smaller granules are situated at the superior, the larger at the inferior parts of the conceptacles; and, although probably differing only in degree of development, have received the names, the superior, of *anthers*, the inferior, of sporidia or granules.

(848.) SALVINIACEÆ. *Azolla*, a New Holland plant, and *Salvinia*, are contained in a type, called, from the normal genus, *Salviniaceæ*. They are known from the Marsileaceæ by the conceptacles being dimorphous, *i. e.* of two kinds, as in *Isoetes*, but free in the axillæ of the leaves, not included in their bases; and from the *Lycopodiaceæ*, by their being indehiscent. These con-

ceptacles contain the two sorts of corpuscules already described in the allied sections, and which are said to germinate with similar phenomena; but they require further examination.

(849.) Collectively the two types, *Salviniaceæ* and *Marsileaceæ*, constitute the section *Marsilinæ*, which, with the *Lycopodinæ*, including *Isoetaceæ* and *Lycopodiaceæ*, are the only two into which the foliose or Moss-ferns (Bryopterides or) Selaginales, have been hitherto distributed. Their solid, leafy, or not frondose stems, and radical or axillary fructification, associate this section, and distinguish them as an order from the other ferns. To the Pteridales they are most closely allied, by their non-fistular axis, jointless stems and branches, and circinate vernation, but their leaves, and the negative character of being not dorsiferous, will readily distinguish them from an order which has been sometimes differentially described as the Epiphyllospermæ or Filices dorsiferæ.

PTERIDALES, OR FILICALES.

(850.) The *Lycopodiaceæ* of the moss-ferns not improbably pass on one side by the vegetation of the naked claw-wort (Psilotum), and by the spiked conceptacles of the club-moss to the *Equisetaceæ* or shave-grasses; indeed, by Willdenow they were put together, and called by him the 'Stachyopterides,' or spicate ferns: but, as the linear tract a history pursues cannot always follow the devious path that nature loves, it will be more convenient to describe the frondose ferns the next, and to conclude the class by a notice of the jointed ferns, which have many affinities with the grasses. The peculiar vernation of the *leaf-ferns*, which is *circinate*, *i. e.* folded inwards as if the fronds were rolled upon themselves, clearly points out their affinity with the preceding order, in which a similar disposition prevails; and, as it is rare, it becomes an important feature, connecting the Selaginales and the true ferns with the Zamiales of the Zapini; a distant order, and yet one in which it would seem that nature, while perfecting a higher internal organization, had fallen back upon herself, and repeated the external form of a lower grade.

(851.) The frondose ferns, *Pteridales*, (called likewise Phyllopterides, Filices dorsiferæ, or Epiphyllospermæ,) are probably those which the translators of Linnæus had in view when they rendered his synonyme, *Novaccolæ* or colonists, *Gipsies*, from the circumstance of these plants, like gipsies, bearing their offspring on their backs. They are by far the most numerous and familiarly known of all the ferns; and indeed, by some persons they have been considered as

the only true ones; but it seems better that the common name should include the whole in one class, as was done by Linnæus and Jussieu, and a subsequent distribution distinguish the several orders.

(852.) The ferns of this and other temperate regions are comparatively humble plants, their true stems generally creeping on the surface of the earth, as in the *Lycopodiaceæ*, or even being subterranean, as in most of the frondose ferns, the parts which are usually considered stems being in reality only branches; but in the West Indies, in St. Helena, the Isle of Bourbon, and other hot insular situations,

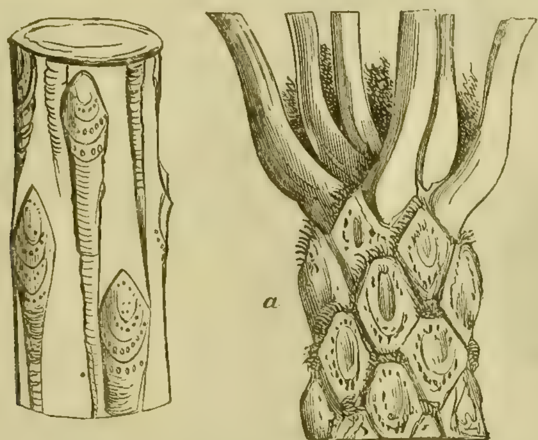
Cyathea glauca, and other arboreous ferns, natives of the Brazils and of the Isle de Bourbon.

arboreous species are found, the stems of which rise out of the earth, and elevate their crown of fronds to the height of twenty, thirty, or forty feet, or even more. In the British Museum is a stem of *Alsophila*, brought to England by Dr. Wallich, that measures forty-five feet; but seventy or eighty feet are occasionally attained. In these noble examples of the class, the true structure of the stem and affinities of the plants in general with palms, and even with cycases and pines, is much more obvious, even to the common observer, than in the suffruticose and herbaceous brakes that are now indigenous to these northern latitudes. Even the Aspidia or shield-ferns, which do form a dwarfish stem and collect their fronds into a crown, hold only the same comparative rank to the arboreous species as onions or lilies do to palms; or our herbaceous cresses to our forest-trees; and the ferns with subterranean stems, like our eagle-brakes and horsetails, are only to be compared with the tree-ferns in the same way in which fodder-grasses are compared to canes and towering bamboos, or rushes to the loftiest palms.

(853.) Hence, among ferns, there will be found the same modifications of the

vegetative organs, as, among other plants, some are herbaceous, some undershrubs, some scandent like woodbines, and others sturdy and arboreous, like ordinary trees.

(854.) The stems of ferns, like those of palms, and most other plants in the two following classes, which by many points of structure are associated with them, maintain an equal diameter throughout their entire height [§ 852]; but a curious circumstance has been noticed by Brongniart, viz. that, although the stems do not vary in diameter, they continue extending lengthwise even in the oldest parts; a

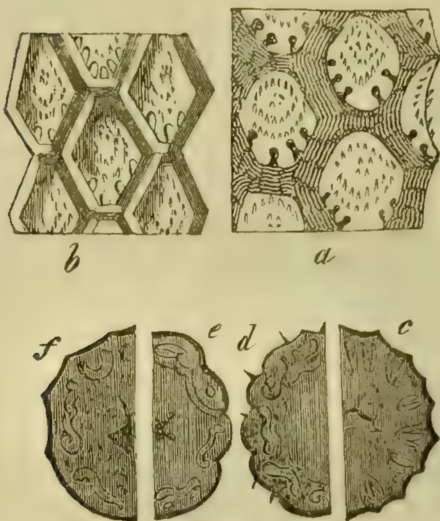


Upper and lower parts of the stem of *Cyathea arborea,* from Haiti, shewing the greater distance of the scars on the lower part (*b*,) than on the upper part (*a*); thus proving the growth even of the oldest portions which are constantly extending in height, as marked by the increasing distance of the scars.

fact which is proved by the gradual recession of the leaf-scars from each other; for, in the upper and younger portions, as at (*a*), they are crowded as closely as the fronds could be exserted, while at (*b*,) a section from the lower part of the same stem, although once as close, they have become gradually more distant.

(855.) The frondose-ferns or brakes, (Pteridales or Filicales,) have the cuticle furnished with stomata even more abundantly than the mossy ferns, and the structure of their stems becomes still more characteristic of that region of the vegetable reign or kingdom in which they are arranged; for, not only are the fascicles of tubes often more numerous, [§ 834, fig. B, C, D,] but among them there have lately been discovered, by a very skilful vegetable anatomist, Mr. Valentine, true tracheæ or spiral vessels, capable of being unrolled, which marks another rise in this gradual series of developments. The fascicles of tubes and fibres seem to be on the whole less uniform in their arrangement in the frondose ferns, than in the Selaginales; but, although they are very variously arranged in different examples, each species maintains a constant similarity in their disposition. In the common Brake (*Pteris aquilina*), they somewhat resemble a two-necked spread eagle, whence indeed that plant derives its specific name, and other species exhibit other forms [vide fig. *c, d, e, f*], some of which have been likened to various letters, and others to elaborate ornamental figures. This similitude of internal structure does not extend to the genera into which the species are now collected. These fibro-tubular fascicles, which give the chief strength to the stems and fronds, and,

by their dispersion, form the rachis and costules of the foliaceous expansions, are embedded in cellular structure, which in the fronds is chiefly external, and in the stem chiefly internal; so that the stem of an arboreous fern very much resembles



(*a*, *b*,) Marks left by the decayed fronds on the stems of tree-ferns, forming a spurious bark.

(*c*, *d*, *e*, *f*,) Transverse sections of the stems of various ferns, to shew the irregular distribution of the fascicles of tubes.

that of a palm, not only from its permanent cylindrical form, but also in the harder parts being external, and the centre being either hollow, or filled with a soft pulpy matter, which is often eaten as food, like the soft pulp of the sago-palm. Although the fascicles are collected into more regular figures in the ferns than in the palms, they are never distributed into strata of wood and bark, nor is the parenchyma disposed in radiating plates, extending from the circumference to the centre. They have indeed neither true wood nor true bark, their stems being unstratified. In prostrate and subterranean Stipites, roots proceed in abundance from the lower sides, while the fronds or branches are developed on the upper. In arboreous ferns this tendency to protrude adventitious roots from all parts of the stem, is often very evident, [§ 834 A,] and the descending fibres sometimes form a kind of adventitious shaggy tegument, which apparently increases the lower part of the stem to three or four times its absolute diameter, and gives it a conical character. In the perennial creeping stems, the original roots and rootlets die, and the plants successively form new ones, the old ones progressively decaying; they however, in some cases, are persistent through many years, and have been traced ten or fifteen feet in length, or even more.

(856.) When the cormus, which in *Isoetes* is small and insignificant, becomes elongated, as in the underground creeping or climbing stems of Pteris aquilina, Lygodium scandens, or *climbing snake's-tongue*, or still more in the Dicksonia arborescens, Cyathea arborea, and other tree-ferns, it is denominated a stipes, and from it the fronds proceed, the foot-stalks of which have unaccountably usurped the name that belongs properly to the stem alone. The fronds, which represent foliage and fruit conjoined, are formed by the divergence of the fibres of the stem or *stipes*, and the foot of each branch is generally, as above stated, called *stipes* also; *peridrome* has been substituted by some filicologists, but perhaps stipitella would be a better term.

(857.) The fronds are often spoken of as leaves; they, however, are not such, and have more the character of boughs or branches, the edges of which are expanded into membranous wings, as is not uncommon in plants still higher in the scale of nature: their power of producing roots, and being gemmiparous, although not absolutely conclusive, are, when combined with their characteristic peculiarity of bearing fruit, circumstances strongly corroborative of this opinion. These winged expansions, or fronds, are sometimes simple, as in the hart's-tongue (*Scolopendrium*), and saw-fern (*Xiphopteris*,) [§ 859;] at others more or less compound, according as the continuation of the stipitella, (which, as soon as the expansions begin, is called the Rachis,) is more or less divided, of which Aspidium, Pteris, &c. [§ 881, A,] afford numerous examples. The venation in the ferns is reticulate, and dichotomous as well as linear.

(858.) The backs of these expanded ramifications exhibit groups (sori) of fruit, which are borne upon their foliaceous fruit-stalks. These sori are sometimes naked, as in the wall-fern, the moon-wort, the royal osmund, &c. [§ 863, fig. *a*, 881, B, &c.] at others they are covered by a membrane called an *indusium*, as in *Scolopendrium*, *Aspidium*, &c. [§ 881, A.] Those sori which are naked are developed upon the frond exterior to the cuticle, those which are *indusiate* are formed beneath the epidermis which is raised by their growth, and the portion raised, which is of various shapes, according to the figures assumed by the heaps of conceptacles or sori, becomes the indusium. The indusium is sometimes single and sometimes double, and dehisces or opens either irregularly or regularly; all which differences afford more or less important distinctive characters of genera, types, and sections.

(859.) The sori [A, B,] consist of groups of cases or thecæ, called conceptacles, [C,] containing *granules*, and each thecæ is either surrounded by an extern

Xiphopteris (or *Grammitis*) *serratula*.

A. Entire plant with several fertile fronds, reduced. B. End of a frond with sori. C. Pedicelled thecæ, shewing the annulus to be a continuation of the pedicle. One conceptacle dehiscing and discharging the granules.

elastic ring called *annulus*, [§ 881, A, fig. *h*,] or is destitute of any such girdle, [863, *f*, *g*;) the first sort of thecæ being named *annulatæ* or *ringed*, the second *exannulatæ* or *ring-less*. The thecæ are occasionally called sporangia or spore-

cases, and the *granules, spores.* These thecæ are sometimes formed of a single cavity alone, at others they are divided into numerous compartments or locules; and the very fine dust discharged when they open or dehisce, consists of the granules which germinate when moisture is present, and develop a small green body, which is regarded as a cotyledon, or at least, as the representative of one. De Candolle observes, that Bernard de Jussieu considered it as such when he placed the ferns among the Monocotyledones. The theca is believed to be a modification of the foliage, and the annulus the metamorphosed midrib.

(860.) Sir James Smith was the first botanist who proposed a really philosophical arrangement of ferns, and his scheme, although very defective, is undoubtedly the foundation upon which those of Swartz, Willdenow, Brown, Kallfuss, and others, have been raised. As the result of much collated labour, it would seem that the Pteridales, or winged ferns, should be distinguished into three chief sections, which, according to Hooker, can be advantageously reduced to two; in one of which the thecæ, or sporangia, are furnished with rings, and in the other are destitute of them; being the *Annulatæ*, or ringed, and the *Exannulatæ*, or ringless sections, of Smith; excluding however the moss-ferns, which he has retained among his Exannulatæ.

(861.) The most familiar genera of these two districts or sections are perhaps, of the former, *Pteris*, the eagle brake, or *Polypodium*, the many-footed fern; and of the latter, *Osmunda*, the flowering osmund, and *Ophioglossum*, the adder's tongue: hence these sections have been called the *Polypodinæ* and the *Osmundinæ*, as *Pteris*, the best known and most common of all, gives name to the order: Pterides being the collective term applied by the Greeks indifferently to all the frondose ferns they knew.

(862.) Both these sections admit further analyses, and have been variously subdivided. The latter contains two types, the *Ophioglossaceæ* and *Osmundaceæ*, each of which may be distinguished into two subtypes, concerning which there is little doubt. Such, however, is not the case with the former; for they differ in two points of organization. In some the conceptacles are *naked*, and in others they are invested with either a *single* or *double indusium*. Again, some have the conceptacles *stalked*, and others *sessile*, or nearly so. Neither of these differences alone being very essential, the *Polypodinæ*, although containing more than half the known genera of this the most numerous section in the class, are usually all retained in one type, as well as in one section. Yet, as this is practically inconvenient, it does seem advisable to seek some distinctive signs; and none are more easy of recognition than those afforded by the absence or presence of the *indusia* and *pedicles*. The genera may thus be distributed into three types; and it is not unimportant to mark, by their association, those genera which have no indusia from those which have, and those which have their conceptacles stalked from those in which they are sessile. The three types thus formed are, first, the *Polypodiaceæ;* second, the *Aspidiaceæ;* and third, the *Gleicheniaceæ.*

OSMUNDINÆ.

(863.) Ophioglossaceæ. *Ophioglossum*, the adder's tongue, (*οφις*, a serpent, and *γλῶσσα*, a tongue,) gives name to this type, which also includes *Botrychium*, the moon-wort, and several tropical genera, called *Danäe*, *Marattia*, *Angiopteris*, and *Kaulfussia*. They are associated by the common characters of their *exannulate conceptacles being bivalved, adnate at the base, coriaceous, and opaque*. The four last-named foreign genera differ, however, from their associates by having their conceptacles plurilocular, and, although half-bivalved, dehiscing by a single longitudinal cleft: hence they are formed into a subtype, named the *Marattidæ;* while the others, in which the vernation is straight, and the thecæ are one-celled and open by two distinct valves, constitute the subtype *Ophioglossidæ*.

(*a, b, c*) *Botrychium Lunaria*, shewing the expanded barren fronds, and the contracted foliage of the fertile fronds.

(*d*) *Ophioglossum vulgatum*.

(*e*) The tumid base of the stem, or barren frond, of B. Lunaria, enclosing the fertile frond.

(*f*) Enlarged pinnule of the fertile frond of B. Lunaria.

(*g*) Ditto with the conceptacles open, to shew the bivalved dehiscence.

(*h*) The spores or grains, greatly magnified.

(864.) *Botrychium Lunaria*, the common moon-wort, was once believed, from the crescentic form of its barren fronds, to be endowed with peculiar powers, and to be especially marked out by nature as a plant under planetary influence: it is now known that its former reputation was wholly undeserved. *Botrychium virginicum*, which is a large American species, is there called the rattlesnake

fern, from its being the favourite resort of those venomous reptiles, and the coverts that it forms should therefore be avoided by travellers, or very cautiously approached.

Angiopteris evecta is an arborescent fern, found by Forster in the islands of the Pacific Ocean. In the Sandwich Isles the natives steep the bruised fronds in cocoa-nut oil, on account of their fragrancy; and they likewise use the roots as food, which they call *Nehai.*

(865.) Osmundaceæ. *Osmunda regalis*, the flowering fern, is the largest of all the at present existing British species: its name is of Saxon origin; *Osmunder* being one of the titles of Thor, the Celtic Thunderer, and *mund*, as in *Osmund*, *Edmund*, *Sigismund*, &c., is a well-known adjunct, signifying strength and power.

(866.) The *Osmundaceæ* are exannulate ferns, the conceptacles of which dehisce by a single longitudinal cleft. The conceptacles are likewise further contrasted with those of the *Ophioglossaceæ* by being pellucid and reticulate, or rayed, at the top.

(867.) *Todea* is an African fern, separated by Willdenow from *Osmunda*, and dedicated to the memory of Tode, a German mycologist. These two genera differ by their reticulated conceptacles opening only as high as a pellucid dorsal projection, from their allies *Aneimia*, *Lygodium*, &c., in which the striated receptacles open throughout their entire length. Hence two minor groups, or subtypes, have been proposed to be established, which may be called the *Osmundidæ* and *Lygodidæ;* of which the foregoing will be the distinctive signs.

(868.) The root of *Osmunda regalis* possesses astringent and styptic properties; it is said to be also tonic, and to have been found serviceable in cases of rachitis, but it is at present very little used. The variations common in the fronds of this plant afford excellent illustrations, with *Ophioglossum*, *Botrychium*, &c., of the contraction of the leafy portion of the frond, which often can be traced in every stage of abortion. The *Lygodia* are the best examples that can be given of scandent ferns. *L. scandens* and *circinatum* are East Indian plants; *L. palmatum*, a handsome North American climber.

(869.) The exannulate conceptacles of both the types *Ophioglossaceæ* and *Osmundaceæ* associate them in the section *Osmundinæ*, which is thus easily distinguished from the *Polypodinæ*, in which the conceptacles are invariably ringed.

POLYPODINÆ.

(870.) The plate or projection whence the radiated striæ proceed in the *Osmundaceæ* is morphologically considered to be the rudiment of the ring, which becomes developed as a distinctive character of the present section; and the transition is marked here by the border genera, *Parkeria* and *Ceratopteris*, or *Ellobocarpus*, having the annulus broad and zone-like.

(871.) The three types included in this section are named, from their three normal genera, *Gleichenia*, *Aspidium*, and *Polypodium*, the *Gleicheniaceæ*, *Aspidiaceæ*, and *Polypodiaceæ;* and in them the conceptacles are either sessile or stipitate, and the indusia either double or single, or absent. The common or associating character of the section is the annulus or ring with which each conceptacle is girded round.

(872.) GLEICHENIACEÆ. Some of the genera included in this type have been called *desciscent* ferns, and all of them excluded by Sprengel from his Filices veræ, nothing being more unsettled than the extent of meaning to be attached to the phrase *true ferns*, as used by various writers. This group, which is small, appears to be transitional from the exannulate section; for, like the *Osmundinæ*, the conceptacles are sessile or subsessile, (sessile in the majority of the genera, and very shortly pedicled in only one subtype;) the dehiscense is likewise for the most part regular in longitudinal clefts; and the annuli, although distinctly developed, are broad and zonate, not forming narrow sailliant rings, as in the two following types.

(873.) The *Gleicheniaceæ* afford examples of three progressive grades or stages of development, and are therefore distributed into three subtypes, called, from their respective normal genera, the *Gleichenidæ*, *Parkeridæ*, and *Hymenophyllidæ*.

(874.) GLEICHENIDÆ. *Gleichenia*, *Mertensia*, and *Platyzoma*, shew an affinity to the *Osmundidæ*, by the capsules being occasionally subsessile. Their distinctive characters are the following: "conceptacles dehiscing by a regular longitudinal cleft, and surrounded by an entire broad elastic ring or zone, which corresponds with the attachment of the conceptacles."

Prince Maximilian, in his travels, states that the Brazilian negroes make the tubes of their pipes of the stalks of the *Mertensia dichotema*, which they call *Samanbaya*.

(875.) The genera *Parkeria* and *Ceratopteris*, or *Ellobocarpus*, form the next subtype, the *Parkeridæ*; the associating and distinctive characters of which are: "sessile conceptacles, dehiscing by a regular longitudinal cleft; ring broad, very short, and incomplete; and seminules few in each conceptacle."

(876.) The *Hymenophyllidæ*, that connect this type to the following, in which they are often included, are distinguished from it by their sessile conceptacles, irregularly dehiscing, their complete elastic annuli not corresponding with the insertion of the conceptacles. The two last-named characters also distinguish them from the two associated subtypes with which, by the former, they are allied.

Both *Trichomanes* and *Hymenophyllum* are extremely elegant ferns, the foliage being fine and membranous, and almost transparent. They have not as yet been applied to any useful purposes, and have hitherto baffled the art of the gardener, and refused to be domesticated as ornamental plants.

(877.) Aspidiaceæ. All the annulate dorsiferous ferns with indusia and stalked conceptacles are comprehended in this, which is the largest type of all. It contains about forty known genera, which are divided into two subtypes, in one of which, as in *Onoclea*, the indusia are double; in the other, as in *Aspidium*, they are single. The subtypes are therefore respectively named the *Onocleidæ* and the *Aspididæ*.

(878.) Onocleidæ. *Onoclea*, and its allies, *Struthiopteris*, *Vittaria*, *Diplazium*, &c., are *annulate, dorsiferous ferns*, having *double indusia, i. e.* the indusia or coverings are placed on both sides of the sori; hence they are distinguished, and form the subtype *Onocleidæ*.

(879.) The *Diplazia* are handsome ferns. *D. auriculatum*, a native of the Caraccas, is arborescent. *D. esculentum* is resorted to for food by the natives in Hindoostan. The *Struthiopterides*, as their name imports, have splendid fronds, bearing some resemblance to ostrich feathers. One species of Onoclea is of such delicate structure, and so impatient of mechanical violence, that, although it will bear our climate well, it withers if much handled. Hence it has received the name of *Onoclea sensibilis*; and some marvellous tales are told of its discriminating powers with regard to the innocence of the persons by whom it is approached.

(880.) Aspididæ. All the annulate dorsiferous ferns with single

indusia are comprehended in this, which is therefore a very large subtype. It contains many important genera, of which the following are examples: *Aspidium*, *Pteris*, *Asplenium*, *Blechnum*, *Lomaria*, *Lonchitis*, *Adiantum*, *Davallia*, *Dicksonia*, and *Cyathea*.

(881.) The Brakes or frondose ferns, are not very extensively employed by man, either as food or in medicine. One species only finds a place in our national pharmacopœias, although several are possessed of curative powers, and are esteemed officinal plants in

A. *Aspidium Filix mas.* (*a*) Upper part of the frond, shewing the rachis and pinnæ, reduced. (*b*) The lower part of the frond, shewing the rootlets springing from the horizontal stem, or common stipes, with the remains of the old stipitellæ; one in a mature state, and another young one, shewing the circinate, or crozier-like vernation. (*c*) A fertile pinnule, detached. (*d*) An indusium, removed with some of the conceptacles attached. (*e*) The granules, or sporules, discharged from (*f*, *i*) two conceptacles burst by the elastic power of the annuli; spores being discharged. (*g*) A conceptacle detached before dehiscence, to shew its pedicle and ring. (*h*) Ditto, in its natural position.

B. *Polypodium vulgare.* (*a*) Two mature fronds springing from the creeping stipes; also a young frond, shewing the circinate vernation. (*b*) Fertile pinnule, detached. (*c*) A pedicled annulate conceptacle, detached. (*d*) A group or *sorus* of conceptacles, without any indusium.

our provinces, and are entered by authority in the continental lists of the vegetable materia medica. Even the Aspidium filix mas, the

only fern our colleges retain, is very rarely used; and yet, from its having been celebrated as an anthelmintic from time immemorial, and more especially from its never having been lauded as a panacea, like many fashionable medicines, which run their course and are forgotten, but always possessing a certain degree of reputation, it is not unreasonable to believe that it deserves it; and, if so, that it does not merit the neglect that it meets with here. The so-called male fern was recommended as a vermifuge by Theophrastus, Dioscorides, and Galen; and its administration formed the ostensibly specific, if not the most energetic, part of the treatment recommended by Madame Noufer in cases of tape-worm. But it cannot be overlooked that she accompanied its exhibition with a strong dose of calomel, gamboge, and scammony, the very ingredients that formed the famous "Pulvis Trium Diabolorum," and which were thought, in their alliance, to be powerful enough to discomfit even a more stubborn enemy than tænia.

(883.) The Scythian or Tartarian lamb [vide § 5,] is a species of Aspidium. Of this fern so many wonderful tales have been told, and supported by such evidence, that the world has doubted whether to discredit or believe them. Struys, who travelled through Russia, Tartary, &c., in the middle of the seventeenth century, gave one of the earliest and best accounts of this curious plant, and the following extract is almost a literal translation from his work.

"On the western side of the Volga there is an elevated salt plain of vast extent, but wholly uncultivated and uninhabited. On this plain, which furnishes all the neighbouring countries with salt, grows the *Boranez* or *Bornitsch*. This wonderful plant has the shape and appearance of a lamb, with feet, head, and tail distinctly formed. Boranez, in the language of Muscovy, signifies a little lamb, [Kæmpfer says that the sheep of the country are called by the people dwelling on the borders of the Caspian Sea, Borannek;] and a similar name is given to this fern. Its skin (continues Struys) is covered with a very white down, as soft as silk. The Tartars and Muscovites esteem it highly, and preserve it with great care in their houses, where I have seen many such lambs. The sailor who gave me one of these precious plants, found it in a wood, and had its skin made into an under-waistcoat. I learned at Astracan, from those who were best acquainted with the subject, that the lamb grows upon a stalk about three feet high; that the part by which it is sustained is a kind of navel, and that it turns itself round, and bends downwards to the herbage which serves for its food. They also said that it dries up, and pines away, when the grass fails. To this I objected, that the langour and occasional withering might be natural to it, as plants are accustomed to fade at certain times. To this they replied, that they had also once thought so, but that numerous experiments proved the contrary to be the fact; such as cutting away, or by other means corrupting or destroying the grass all around it; after which, they assured me, that it fell into a languishing state, and decayed insensibly. These persons also added, that the wolves are very fond of these vegetable lambs, and that they devour them with avidity, because they resemble in taste the animals

whose name they bear; and that, in fact, they have *bones*, blood, and flesh; and hence they are called zoophytes, *i. e.* plant-animals. Many other things I was likewise told, which might however appear scarcely probable to such as have not seen them." (*Struys' Travels*, vol. ii. pp. 28—31.)

(884.) This wonderful tale of Struys, like many other similar stories, although very much perverted, is based on truth. The rhizoma of the *Aspidium Baromez* does present, when the fronds are removed, a rude resemblance in its shape to the figure of an animal, as shewn by the sketch in § *5*. It is covered by a soft downy substance, which may be compared to a silky fleece, but from which no under-waistcoat could be made. This fleece is of a reddish-brown colour, and not white. Like the stems of other ferns, the inner parts are soft and pulpy; and it so happens that they have something of a flesh colour, and that the sap is of a rich red hue, resembling blood. From these materials the fable has been composed; and from far less truth much more wonderful histories have sprung. Ferns often grow in barren soils; and, as these vegetable lambs are found on the salt plains, it is not improbable that in such situations they are often seen without grass in their vicinity: but that the herbage is consumed by the fern, or the plants devoured instead of lambs by wolves, although speculations which the wonder-seeking traveller might be tempted to indulge in, it need not be said are ornamental additions, introduced to suit the taste of the narrator, and to pander to that love of the marvellous which prevailed in the age in which he lived.

(885.) The Baromez possesses astringent properties, which are common to all ferns, in a somewhat greater degree than many other species. Hence it was formerly much in repute as a styptic, and both its flesh and fleece were used to restrain immoderate sanguineous fluxes: it is now seldom, if ever, used. Fresh plants are often brought to the markets at Macao, but none have ever yet reached this country alive.

The *Aspidia*, or shield ferns, have been so named from the resemblance their indusia bear to little bucklers (*ασπιδιον*.) *Aspidium fragrans* has been employed as a substitute for tea; and Dr. Buchanan states that the roots of *Nephrodium esculentum*, one of the species in a subgenus of *Aspidium*, are eaten in Nipal.

(886.) *Pteris*, the name given by the Greeks to the leafy ferns in general, on account of their winged or feathery appearance, although now restrained to a single genus, still includes, according to Sprengel's catalogue, 119 known species. Of these but one, the *P. aquilina*, is indigenous to Britain. This, the common eagle brake, is well known as forming excellent cover for game: it abounds on all our heaths and commons, and is the favourite haunt of deer. From its constant profusion in every part of the country, it is not improbably the especial *Fearn* of our Saxon ancestors, from which so many places, as *Fearn*ham or Farnham, Farnhurst, Farnborough, Farnworth, Farningham, &c. have been

named. The fronds are used as litter in the farm-yard and stable; and, in the north of England, cottages are often thatched with it. It is eaten, though sparingly, by cattle; but in the Canary Islands the roots are, according to Humboldt, employed by the inhabitants of Palma and Gomera for food. He says, These poor people grind it to powder, and mix it with a small quantity of barley-meal. This composition, when boiled, is called *gofio;* and the use of so homely an aliment is, as he continues, a proof of the extreme penury of the lower orders in these places. The astringency of the plant must render it a very unpalatable food; for it is so great, that it has been recommended for dressing and preparing kid and chamois leather; and, like the *Aspidium Filix mas*, it has been also used as a vermifuge. A bed made of the plants in a fresh and green state is considered by the country people a sovereign remedy for rickets. The fronds form the best packing for apples which are to be kept, not imparting any unpleasant flavour, and preserving the fruit longer than other means. The ashes, from the alkali they contain, are used in the manufacture of soap and glass. Both Pteris aquilina and Aspidium Filix mas have been employed in brewing; and, from the analysis of the latter which has been made by Morin, it is probable that they would form one of the best substitutes for hops, as they contain both gallic acid and tannin, which are absent from most of the other bitter plants which have been proposed as surrogates, and failed, from being unable to precipitate the glutinous mucilage which renders unhopped beer so liable to turn sour.

Pteris esculenta, a native of the southern hemisphere, is said by Forster to be employed by the inhabitants of the Society Isles as an article of diet: but he says the roots are fibrous, and contain very little nutritious matter.

(887.) The *Asplenia* [§ 68, fig. B,] were formerly considered powerful remedies in diseases of the spleen, and even to be able, if used in excess, to annihilate that viscus; and hence the generic name (*α σπλην*:) they are, however, simply bitter and slightly tonic. The fine fronds of *Asplenium lucidum* are regarded in some of the Polynesian isles as emblems of sorrow, being carried by the mourners in their funeral processions.

(888.) The genus *Adiantum*, so called from (*αδιαντος*, *dry*,) because, says Pliny, in vain you plunge it in water, you cannot wet it, contains several very delicate and beautiful species: amongst these is the *Maiden's-hair*, or *A. capillus veneris*, that is used to

flavour the well-known syrup *Capillaire*. Both this plant and *A. pedatum* are astringent, and have been recommended in pectoral disorders. Dr. Ainslie says, a strong decoction of the latter is a certain emetic, and that A. melanococcum is reputed in India to be a tonic.

(889.) *Davallia canariensis* is a curious fern, and well deserving notice. It is commonly called the *hare's-foot*, from the very great resemblance of the rhizoma or stock to the foot of the animal whose name it bears.

(890.) *Cyathea* is also an interesting genus, from containing several arboreous species, [§ 6, 852.] C. medullaris, (the *Polypodium* medullare of Forster,) which grows in New Zealand, and is called by the natives *Mamagu*, is there esteemed as an article of food. The New Zealanders bake the roots and the lower parts of the stem, which are soft and pulpy, and have a pleasant smell and taste; so that the medulla of this fern, which abounds in a reddish glutinous juice, is nearly as good as sago.

(891.) POLYPODIACEÆ. *Polypodium*, and its allies, Acrostichum, Grammites, Ceterach, Gleichenia, Mertensia, Platyzoma, &c. are associated to form the type Polypodiaceæ, which is distinguished from the other annulate ferns by the absence of the indusium, the ringed conceptacles being uncovered, [§ 874, fig. B, *d*.]

(892.) *Polypodium vulgare*, the common wall-fern, or Polypody of the oak, has long been famed for its expectorant powers. It is the 'rheum purging polypody' of Shakspeare. The root is sweetish, and, when powdered, has been employed as an external absorbent, and also as a covering for pills; but, excepting in domestic medicine, it is now very seldom used. Like the Pteris, it is burned, for the sake of the potash procured from its ashes, which is used in the manufacture of glass. P. calaguala, the root of which has an oily disagreeable taste, is said to be a sudorific, and enjoys in America the reputation of being anti-rheumatic. *P. crassifolium* is also used for similar purposes; and both are spoken of as excellent alteratives. The fronds of *Polypodium phymatodes*, like those of various other ferns, are aromatic, and by the natives of the Sandwich Isles they are used, as well as the fragrant Angiopteris, to perfume cocoa-nut oil. The *Ceterach officinarum*, which is the *Chetherak* of the Persian physicians, has been recommended in jaundice: and various other ferns both have been, and might be, applied to various other useful purposes; but as illustrations of the type, the foregoing will suffice.

(893.) The *Polypodiaceæ*, *Aspidiaceæ*, and *Onocleaceæ*, which differ, in the presence or absence of indusia, agree in all having annulate conceptacles, and hence they are associated in the section *Polypodinæ*, or annulate ferns: and, although thus differing from the exannulate types *Osmundaceæ* and *Ophioglopaceæ*, included in the section *Osmundinæ*, they accord with them in their *dorsiferous foliaceous fronds*, and in their fruit being uniform. They hence, collectively, form the order *Pteridales*, sometimes called Filices or *Filices veræ;* but, as these are no more truly ferns than the other orders, Pteridales, from *Pteris*, the original Greek name for this group in general, is here preferred as the common title.

EQUISETALES.

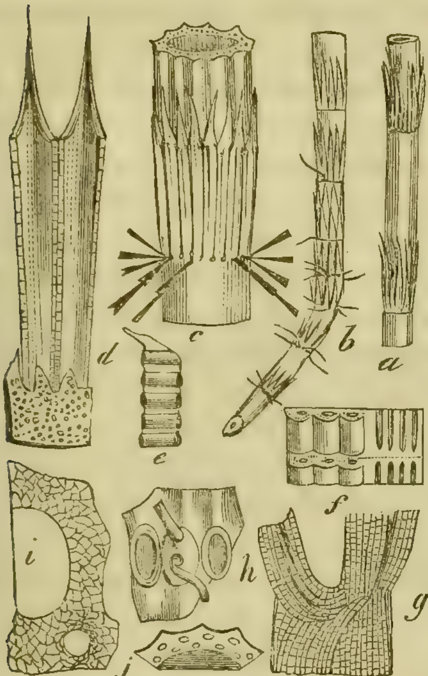
(894.) Beautiful as are the (*Equiseta* or) *jointed-ferns*, which now exist, they have none of that majesty of port which characterized their predecessors of the ancient world; nor are there any arboreous species of this order known to have escaped extermination, as the leafy tree-ferns of southern latitudes have done: the only records that we possess of their antediluvian existence are derived from the gigantic remains that are continually found, by geologists, embedded in various strata.

(895.) Like the more humble of the leaf-ferns, the true stem or stipes of the jointed ferns is situated beneath the surface of the ground, and sends up at intervals its branches or *stipitellæ:* the structure of the stipes differs not greatly from the subterranean stipes of other ferns, but the structure of the stipitellæ or branches that rise above the surface are different in the extreme. They are destitute of any foliaceous expansions, either in their primary or subordinate divisions: they are jointed or articulated at regular intervals, the joints or *nodi* being solid, the spaces between them, (the internodia or internodial spaces,) hollow. At first they contain internally a delicate cellular tissue, but this becomes obsolete during the growth of the plant, leaving a cavity that extends from joint to joint.

(896.) The stipitellæ are frequently quite simple, the nodes being merely surrounded by an annular membrane; at others, from each knot there spring whorls of secondary branches with short bristly processes, which may be considered as the representatives of leaves. The cuticle, which covers the whole of the stipitellæ, is perforated by many stomata, which are situated in the grooves or

channels that traverse them from end to end. A transverse section of these stipitellæ discovers the large central cavity and two circular rows of smaller channels, traversing the vascular parietes of the larger cavity, [fig. *a*, *c*.] The general substance of these plants consists of numerous cells, more or less elongated, accom-

Equisetum fluviatile.



(*a*, *b*) Sections of the stipitellæ shewing the jointed structure, the whorled adventitious rootlets, and the circular sheaths.

(*c*) Enlarged section, shewing the central hollow cylinder and the ring of lacunæ, also the sheath, and the small leaf-like projection of which it is formed, with the origin of the whorled branches in an infra-axillary position.

(*d*) Portion of the vagina enlarged, to shew its structure.

(*e*) The annulate vessels, that surround the lacunæ, shewn by one of the lacunæ being opened.

(*f*) Sections at a joint, shewing the interruption of the lacunæ at each articulation.

(*g*) Longitudinal section through a joint, passing through one of the large lacunæ.

(*h*) Exsertion of the roots from a tubercle at the joint.

(*i*) Transverse section through the internodium, shewing the large external and small internal lacunæ with the cellular structure.

(*j*) Section through an internodium, shewing the concentric large and small lacunæ.

panied and intermingled with false tracheæ or annulate tubes. Their cuticle is regularly and beautifully decked on its internal surface with innumerable minute pieces of flint, arranged in lines and other forms, often not the one five-hundreth of an inch in diameter; and yet so closely set, that in some cases the whole of the vegetable matter has been removed, the silix alone remaining, and still the plant retained its form.

(897.) The fructification of these plants is collected into spikes at the ends of their fronds, [§ 68, D] many of which are barren; the fertile ones exhibit numerous thecæ, which are wedge-shaped and covered by corneous indusia, which, however, are better considered as scales to which the thecæ are attached. The thecæ, which are one-valved, burst lengthwise, and discover within them numerous small green bodies or granules, (called sporules by some,) which have each four elastic filaments springing from the base.

When dry these filaments are curled up, but when moist they expand, and it is probably by this expansion that the thecæ are burst open. Each of these granules, with its filaments, may be considered as a rudimentary flower, the granule being a naked ovulum, (according to Brongniart,) and the four filaments, which have swollen apices, rudimentary anthers, with the pollen which should fertilize the ovule; but still smaller grains are likewise to be found, which others consider the true pollen, and the filaments as the threads of rudimentary anthers.

(898.) The granules of these plants have by some persons been supposed to be true seeds, and to possess the cotyledon or seed-lobe, which is developed as a characteristic of the following class. But, when these granules are watched during germination, the supposed cotyledon appears to be rather the result of growth, like the pseudo-cotyledons of the other ferns and mosses, than an organ pre-existing in the granule. The accompanying sketches by Vaucher shew the gradual development of the granule, with its

Germination of Equisetum.

(*a*, *b*) Granules swelling and beginning to protrude the roots. (*c*) The root formed, and the supposed cotyledons developed. (*d*) Same parts farther advanced. (*e*) A young plant with its first whorl of branches. (*f*) Ditto stem beginning to be formed. (*g*) Last figure, natural size.

primordial and secondary expansions, which, although forerunners, of cotyledons, are not really such.

(899.) A very considerable analogy will be found to subsist between these plants, especially in their organs of fructification, with an order to be subsequently described, viz. the Pineales, along with which the cycases are arranged, and in which the ovules are

naked, the seeds collected into cones and covered by scales; just as is here observed.

(900.) Only a single genus, Equisetum, is known, which therefore stands alone in the type Equisetaceæ, which is the only one in the section Equisetinæ. By some these ferns have been called *Gonyopterides*, on account of the jointed stem so very characteristic of the order.

(901.) The leafless ferns or Equiseta, are not often used in medicine, although, as diuretics, they have been much extolled. Few animals feed on them, and they are said to be injurious to pigs; while horses, sheep, and asses, eat them with impunity. Linnæus affirms that reindeer, who refuse to eat hay, will eat the E. fluviatile, and that it is cut as fodder for kine, but that it is not so acceptable to horses. Several species of *Equisetum*, particularly *arvense*, *sylvaticum*, and *variegatum*, often form tubercles on the subterranean stems, like those of potatoes; and as, according to Haller, the E. fluviatile was eaten by the common people among the Romans, it was probably these tubercles, which are replete with starch, that were the parts selected as food: and hence, in all likelihood, this plant was the CHARA mentioned by Cæsar [§ 795,] for it abounds on the banks of lakes and rivers, and in other swampy places. They contain much flint, as already mentioned, in a very minute state of division, and which is spread over their cuticle, and thus renders them admirable natural files. Hence botanists sometimes use them to smooth their nails; and cabinet-makers and workers in marble employ large quantities for polishing their finer works. One species especially, viz. the E. hyemale or shave-grass, is imported from Holland for these purposes, under the name of *Dutch-rush*. When plates and other utensils for culinary and table service were made of pewter, the Dutch-rushes were in very great request in the scullery; the whitesmiths use them now, and the superior polish they give to their works depends upon the peculiar fitness of the exceedingly fine flint for such purpose. The milk-maids in the dairy counties still use the shave-grass to clean their pails.

(902.) The Equisetales or shave-grasses, (the Prêles of the French,) are leafless, flowerless, tubivascular plants, with sheathed, hollow, jointed stems, uniform fructification collected in terminal spikes or cones; the conceptacles enclosed by scales, and the sporules surrounded by elastic filaments; vernation straight.

(903.) These three orders, *Equisetales* (or shave-grasses), *Pteridales* (or brakes), and *Selaginales* (or moss-ferns), constitute, collectively, the class FILICES or FERNS: the first of the region to which it belongs; but in which, notwithstanding the great advance in organization and vast development of the vegetative system, the organs of fructification are still so slightly evolved, and so obscure, as to have in general caused them to be placed lower in the scale than their structure would allow. Yet, although with propriety they are denominated flowerless plants, they cannot, without violence, be severed from the other tubivascular classes.

(904.) The *Equisetales*, *Pteridales*, and *Selaginales*, which are respectively distinguished by being, 1st, leafless and articulate, 2dly, foliaceous and dorsiferous, and 3dly, leafy, inarticulate, and not dorsiferous, are associated by their tubivascular structure and destitution of flowers and seeds, to form, collectively, the class Filices or Ferns; which is thus easily distinguished from the two following classes, both of which, although, like the ferns, tubivascular, contain none but flowering and seed-bearing plants.

(905.) The annexed table affords a summary conspectus of the whole of the orders, sections, and types, into which the class has been distributed.

Class.	Orders.	Sections.	Types.
FILICES or FERNS. (904)	Equisetales (902)	Equisetinæ (900)	*Equisetaceæ* (900)
	Pteridales or Filicales (893)	Polypodinæ (871)	*Polypodiaceæ* (891)
			Aspidiaceæ (877)
			Gleicheniaceæ (872)
		Osmundinæ (869)	*Osmundaceæ* (866)
			Ophioglossaceæ (863)
	Selaginales (849)	Lycopodinæ (839)	*Lycopodiaceæ* (843)
			Isoetaceæ (840)
		Marsilinæ (846)	*Marsileaceæ* (847)
			Salviniaceæ. (848)

GEOGRAPHICAL DISTRIBUTION OF THE FILICES.

(906.) The three orders into which the ferns have been systematically distinguished enjoy a nearly equal range of geographical distribution; and, although there are some features peculiar to each, the grand characteristics are common to them all.

(907.) In their distribution, the ferns follow a law exactly the reverse of that which regulated the two previous classes, for they abound within the tropics, and decrease both in size and number towards the poles; instead of being most numerous in the cold and temperate regions, and diminishing towards the equator, as was found to be the case with the mosses and the fungi.

(908.) The foliose, frondose, and leafless ferns, although, as natural orders, of

equal rank, differ remarkably in their extent; the one including about 2000, while both the others cannot count 200 existing species between them. According to Sprengel's catalogue, the numbers are, 162 Selaginales, 18 Equiseta, and from 12 to 1500 Pteridales: which last, according to Brongniart, should be increased to at least 2000.

(909.) The frondose ferns will therefore, from their predominance, claim our first and chief consideration; and, as the others are subject to the same general laws, a few words will suffice to explain the special exceptions that occur.

(910.) The following calculation places the first great character in the geographical distribution of the ferns in a very striking point of view. If three zones be supposed to encompass the earth, the central or equatorial zone extending to about 30° or 35° on each side of the equator, and the northern and southern temperate and frigid zones from the 30° or 35° of northern and southern latitude to the poles, there will be found, according to Brongniart, in the northern temperate and frigid zone, only 144 indigenous species, and in the southern temperate and frigid zone 140 species; while the rest of the frondose ferns, amounting to at least 1200, are peculiar to the central or equatorial zone. And not only are the equatorial regions, thus taken in their totality, surprisingly more rich in ferns than the temperate and frigid zones, but if a smaller tract from each were compared, the contrast would be still stronger, for many more species are common to distant countries in warm latitudes than in cold ones.

(911.) It is customary, especially among tubivascular plants, to calculate, not only the absolute number of any given genus or order in any given latitude or country, but also to form a comparative estimate of the proportion it forms of the vegetation of those places, and of its greater or less predominance in such local or general floras.

(912.) The difficulty of ascertaining the number of flowerless cellular plants causes them in general to be excluded from these calculations, which usually refer to the tubivascular plants alone. The known species of flowering plants have been estimated at about 50,000, and the ferns at 2000; the mean relation, therefore, which ferns bear to other tubivascular plants in the vegetation of the earth in general, is as 1 : 25, or, if the foliose ferns alone be taken, as about 1 : 30. The average, however, is liable to excessive variations in different countries, not only as regards their latitude, but also their physical peculiarities, such as the nature of the soil, insular or inland condition, &c.

(913.) Ferns luxuriate in warm, damp, shady situations: where these three conditions are present they are met with in abundance. Heat, without shade and moisture, is unfavorable to their increase, and therefore, although numerous in Jamaica and the other West India Islands, they are rare in the wide valleys of the Andes.

(914.) In different parts of Europe the relation varies from $\frac{1}{35}$ to $\frac{1}{80}$, the average being on the whole, in the temperate zone, about $\frac{1}{70}$, while within the tropics it is $\frac{1}{20}$. In insular situations the proportion rises much higher, ferns being to other tubivascular plants in Jamaica $\frac{1}{9}$, in New Zealand $\frac{1}{6}$; in the Sandwich Islands and in Otaheite it is $\frac{1}{4}$, which appears to be the general average in Polynesia; and in some small mountainous islets, as Norfolk and Ascension Islands, and St. Helena, the proportion reaches even to $\frac{1}{3}$.

(915.) In continental situations, although in the same latitudes, their propor-

tion is much less: thus, according to Humboldt, in the most favorable inter-tropical continental situations, the proportion is not greater than $\frac{1}{26}$ or $\frac{1}{20}$, and in equinoctial America it is $\frac{1}{36}$. In Western Africa and India it is $\frac{1}{26}$, in New Holland $\frac{1}{36}$, in France $\frac{1}{63}$, in Portugal $\frac{1}{116}$, and in the Greek Archipelago $\frac{1}{227}$. The decrease towards either pole is thus very evident; but further northwards, from the diminution of flowering plants, the proportion again rises. Thus, in France it is $\frac{1}{73}$, in Germany $\frac{1}{71}$, in Scotland $\frac{1}{31}$, in Sweden $\frac{1}{35}$, in Iceland $\frac{1}{18}$, in Greenland $\frac{1}{10}$, and at the North Cape $\frac{1}{7}$. Ferns are very rare on Mount Atlas, almost wholly absent from Egypt, and in Melville Island there are none.

(916.) But the number of ferns, whether absolute or relative, is not the only point in which they differ in different regions. The form and structure of these plants bear some relation to the places in which they grow. Thus certain genera, and even certain tribes, are entirely or almost entirely confined to certain determined climates; for example, the temperate and frigid zones scarcely produce any other ferns than the *Polypodiaceæ*, *Aspidiaceæ*, and a few *Ophioglossaceæ*. Hymenophyllum tunbridgense, and two or three species of *Trichomanes*, are the only representatives of the *Hymenophyllidæ*; and the other types, and even numerous genera and species of these, are wholly absent.

(917.) The magnitude of these ferns affords another remarkable evidence of the effects of climate. In the cold and temperate regions they are herbaceous, rarely even shrubby plants; but in warmer latitudes they become frutescent and arboreous. It has been sometimes thought that true ferns are confined to the equatorial zone; but Mertens discovered them fifty feet in height in the Isles of Bonin, near Japan, in the 28° north latitude; and in the southern hemisphere they occasionally extend as far as the 45th degree. Still the torrid zone is the especial region of arboreous ferns, and there, only, are they found in abundance. Beyond the twentieth parallels they are scarce, for, in the southern hemisphere, without the tropics, in New Holland and New Zealand, as yet there have been discovered only two.

(918.) Such are the general statistics of the *Pteridales* or *frondose ferns*, of which those of the Selaginales and Equisetales are very nearly counterparts. For, notwithstanding the outward resemblance the former bear to mosses, they follow geographically the general distribution of other ferns, which is the very reverse of that affected by the plants to which in external appearance they are allied. And thus the at present existing humble species shew a physical as well as a structural agreement with the Pteridales, which becomes still further corroborated when the gigantic Lycopodia, now extinct, are compared with the arboreous ferns that have escaped the wreck of time.

(919.) Of the two sections included in this order (*Selaginales*), the Marsilinæ, which are all aquatic, are found in marshes, rivers, lakes, and other inundated places in various parts of Europe, Asia, Australia, Africa, and America. Like other water-plants, they are less affected by latitude than by locality; but they seem to prefer the temperate zones, and to be less common towards the poles and within the tropics.

(920.) The *Lycopodinæ* extend further, both north and south, than the *Marsilinæ*, being, like the frondose ferns, most prevalent in hot damp situations, particularly in small tropical islands. In the higher latitudes they greatly and gradually decrease, but in the northern parts of England and in Scotland some of

the Lycopodia are common; and even in Lapland extensive tracts are profusely covered with *Lycopodium alpinum*, and *Selaginoides*. Isoetes is found in the still waters of various countries in every quarter of the globe.

(921.) The *Equisetales* are found, like both the foliose and frondose ferns, in every latitude, stretching from the equator to the poles. They are very numerous in the tropical parts of America and Asia; at the Cape of Good Hope they abound, and they continue common in the temperate zones, but become rare towards the polar circles. In New Holland there are none, or, at least, in that country they are as yet unknown.

(922.) Topographically considered, their station is chiefly in marshes, where they form as it were forests, resembling tropical groves of palms in miniature. As they become rare in the frigid zone, so they are seldom found at any great height on mountain-ranges, and are wholly absent from the elevated regions of the Alps; for, according to Vaucher, the E. sylvaticum, which is found at a greater altitude than any other species, never reaches higher than from 300 to 400 toises, [=1800 to 2400 feet.]

(923.) The difference in size in the different species of this genus, according to the climates in which they grow, is another fact well worthy of attention. The two smallest Equiseta known, are the *E. scirpiöides* and *E. reptans*, which are indigenous, the one to Canada, and the other to Lapland; while the largest species, on the contrary, is our *E. giganteum*, that attains five feet or more in height, and which is found in the Antilles.

(924.) The application of these facts is obvious; for a link is thus laid hold of which will connect our modern puny plants with those majestic species which flourished to excess in some of the earlier epochs of this globe. Such facts are therefore curious and important; they possess a value beyond their simple truth; for the knowledge now accumulated of the geographical and topographical distribution of these especially, as well as of other plants, when collated with the geological investigations which at this moment are being carried on with unprecedented ardour, and to an almost incredible extent, cannot fail, as Brongniart has well observed, to throw much light upon the ancient history of the world.

GEOLOGICAL DISTRIBUTION OF THE FILICES, OR FERNS.

(925.) In the various strata of which the crust of the earth is formed, the fossil remains of numerous ferns are found. These, like the vestiges of other plants, occur in very different absolute numbers, and in very different relative proportions, in the successive series of beds which are believed to have been deposited during different geological epochs. Do the geological positions and the structural peculiarities of the primæval ferns accord with the geographical distribution and climatorial modifications of the, at present, existing species? Furthermore, what light, if any, does the collation of facts, derived from both these sources, throw upon the history of the dark ages of the world?

(926.) Some traces of fossil ferns are found in almost every series of strata from the later transition to the beds above the chalk. But it was the coal era in which they were predominant, not only in size, but also in absolute number, and in relative proportion.

(927.) The economical value of coal as fuel has rendered the flora of its epoch more accessible and more familiar to us than that of most others, save our

own. This is evident from the fact, that of the 500 fossil plants now known, upwards of 250 belong to the coal measures; and thus, all the other strata put together produce less than half of the total sum.

(928.) The former relative predominance of ferns may likewise be shewn by a similar calculation. Thus, of 472 fossil tubivascular species enumerated in Brongniart's Prodromus, 226 are decidedly ferns; he reckons them at 290, but 64 are doubtful: and it is more than probable that, hereafter, they will be generally admitted to belong to the subsequent classes, which would otherwise seem to have had only 182 representatives in these early ages.

(929.) The relative predominance of ferns seems to have been greater in the coal era than at any other period. From present data they appear to have then formed more than three fifths of the vegetation of the earth: for, of the 258 tubivascular plants included in the coal flora, 158 are decidedly ferns, while at the utmost only 98 flowering species have been hitherto discovered; and 60 of these, including the Sagillariæ, are considered by Brongniart to be ferns, which computation would increase the former number to 218, and reduce the latter to 38.

(930.) Only three fossil ferns have hitherto been found in the beds below the coal, which Brongniart reckons as part of the transition series; although it is doubtful whether they should not rather be classed with the secondary rocks, and associated with the coal strata. Two of these are representatives of the modern order Equisetales, [§ 935, fig. I, K,] the other of the frondose ferns, [§ 935, C.]

(931.) The earliest traces of any plants allied to the *Selaginales* is in the coal formation; and there, with other ferns, they are most abundant. The excessive profusion in which fossil plants occur in the shale accompanying the coal seams, though well known to all who examine the collieries, is scarcely conceivable by such as are not familiar with the subject.

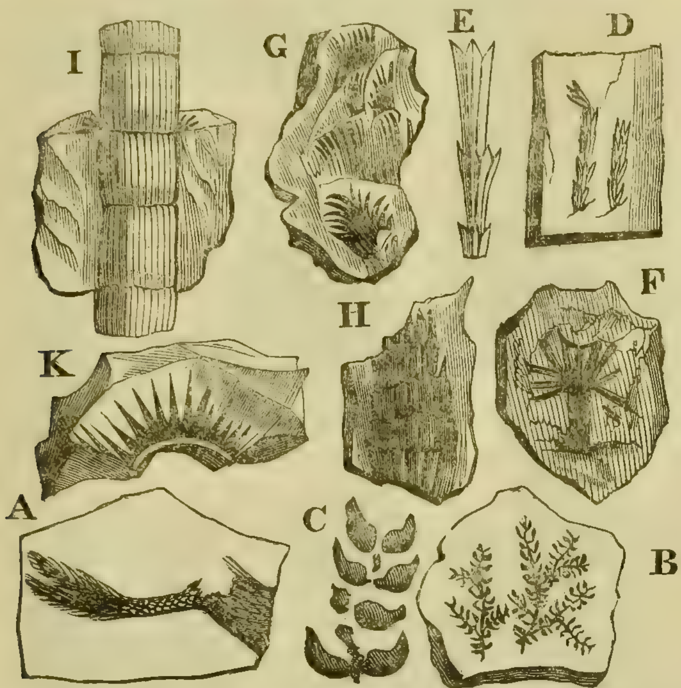
(932.) In the limestone, above the coal, not any vestiges of these plants have hitherto been seen, and in the new red sandstone they are scarce, only six species of frondose ferns and three calamites having been observed. In the Lias and Oolitic series their relative proportion to other tubivascular plants becomes less and less; and the gigantic Lycopodiaceæ are wholly absent. In the beds above the chalk, vestiges of ferns are comparatively very rare, and their numerical relation to other plants is nearly that which the existing species hold in temperate regions at the present time.

(933.) Another problem connected with this inquiry springs from the foregoing generalizations, viz. Are the ferns, the remains of which are found in different strata, identical with species now existing; or in what degree are they related to their successors?

(934.) Some of the fossil ferns are so similar to those now growing on the surface of the earth, that no doubt is entertained they are generically the same; this is the case especially with the Equiseta, many of the fossil remains of which being considered only specifically distinct, are included in the same genus with the existing species, and are called by one common generic name.

(935.) *Equisetum brachyodon*, [fig. D, E,] which Brongniart considers as one of the fossils bearing the nearest resemblance to our modern existing species, is found in the tertiary series; *E. Meriani*, [F,] and *E. columnare*, which differ more considerably from the present forms, belong, one to the variegated marls of the Lias; and the other to the oolite below the Lias. The latter was an arboreous

Equisetum. *E. infundibuliforme*, [G, H,] which deviates still more from the present normal appearance of these plants, is found in the coal strata; and Brongniart



A. Lepidodendron selaginöides. (*Lindley* and *Hutton*, 12.) B. Lycopodites falcatus, reduced. (*L.* and *H.* 61.) C. Ditto, portion magnified. D, E. Equisetum brachyodon. (*Brong.* 12.) F. Equisetum Meriani. G, H. Equisetum infundibuliforme. I, K. Calamites radiatus.

asks whether it may not be a branch of a Calamite, a fossil genus which, though absent from the recent strata, is common in the coal formation.

(936.) The majority of the fossils allied to this order of the ferns are however so different from the modern genus Equisetum, that they are formed into a distinct group called Calamites, a name derived from their once supposed resemblance to a reed or cane; and, although now associated with the Equiseta, the justice of this arrangement is not unquestionable.

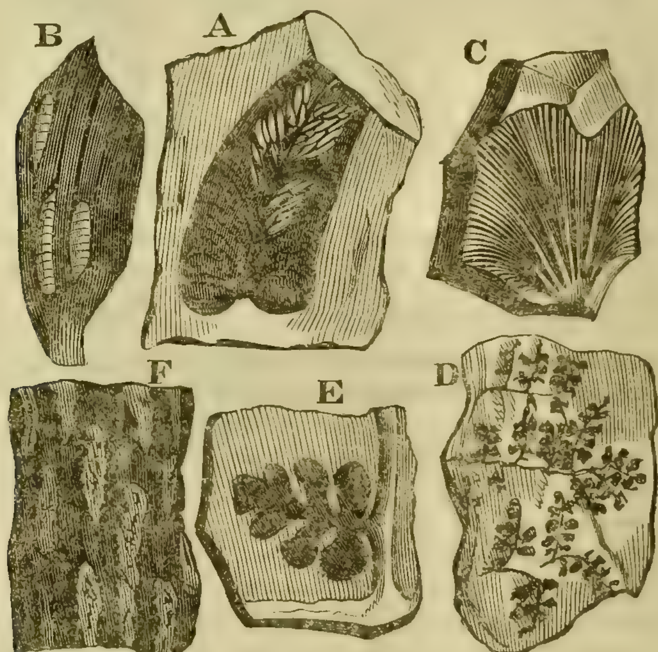
(937.) The *Calamites* appear to have been plants of very considerable magnitude, for fragments are found many feet in length, and some of the stems, as that of *C. pachyderma*, measure five inches, and others, as those of *C. gigas*, even a foot in diameter. It is not, however, their great size which renders it doubtful whether they should be associated with the Equisetales, for the Equiseta themselves gradually assume in the older strata an arboreous form, but the apparent separation of the stem into layers, which structure is foreign to this class and the peculiar characteristic of others. *C. radiatus*, [I, K,] from the transition beds, Brongniart thinks a corroboration of the present arrangement; the radii, [§ 934, fig. K,] or whorled processes at the joints, being by him believed to be equivalent to the vagina of the Equiseta. Another view has been, however, taken by Lindley and Hutton, who would regard the radii as verticillate leaves.

(938.) From the mutilated condition in which fossil plants are ordinarily found,

it is always difficult, and often impossible, to recognize those characters which distinguish the genera and species of the existing flora. With regard to the Equisetales, the smallness of the order, and the great peculiarity of the structure of those plants, reduced the difficulty; but in the large order, Pteridales, the sections, types, and genera of which are founded upon minute and very destructible organs, the difficulty is severely felt.

(939.) Thus, of the numerous fossil frondose ferns, not one has been absolutely recognized as specifically appertaining to any existing genus, although it can frequently be determined to which type or section they belong. Thus, *Pecopteris heterophylla* so much resembles a *Pteris*, especially *P. caudata*, that there can be no doubt that it belongs to the same type, if not to the same genus; and *P. polypodioides* is so like the common wall-fern, that, as Lindley and Hutton observe, it is doubtful "whether, if a recent fern were discovered, with so much similarity, and so little discrepancy, it would be considered more than a variety of Polypodium vulgare."

In several instances even the fructification of the ferns is well preserved, as seen in *Neuropteris flexuosa*, [A, B,] and in *Sphenopteris rigida*, [L, E.] And,



A. Neuropteris flexuosa in fruit, (65.) B. Smaller portion of the same magnified, to shew the venation and disposition of the sori. C. Cyclopteris flabellata, (61.) D. Sphenopteris rigida. E. A pinnule of the same enlarged, to shew the fructification, (53, *Brong.*) F. Caulopteris primæva. (*Lind.* and *Hutt.* 42.)

as Brongniart observes, there are several such remarkable genera in this order, such as *Osmunda*, *Aneimia*, *Lygodium*, *Schizea*, &c. that if vestiges of their fructification remained, they could not fail to be recognized; *Botrychium* and

Ophioglossum also could scarcely escape detection; and the singular fronds of *Schizea* and *Gleichenia* would at once distinguish them, even without the fructification. But as none of these have been discovered in a fossil state, it is probable that the *Osmundaceæ*, the *Ophioglossaceæ*, and the *Gleicheniaceæ*, were not included in the flora of the ancient world; and that, during the epoch of the coal formation, the *Polypodiaceæ* and *Aspidiaceæ* were the only types of frondose ferns existing: for *Pæniopteris*, which approaches by the distribution of its nervures to the *Marattidæ*, belongs to the later beds of the Lias.

(940.) The fossil genera *Neuropteris*, [§ 939, fig. A, B,] *Pecopteris*, *Odontopteris*, and *Sphenopteris*, § 939, D, E,] contain the most numerous species of the coal epoch, and some of them are met with in profusion in almost every carboniferous shale; they are therefore cited as familiar examples: *Cyclopteris flabellata*, [§ 939, C,] is the only species that occurs in the beds below the coal.

(941.) The specimen of *Caulopteris primæva*, [§ 939, fig. F,] found in the Radstock coal-mines, near Bath, and now in the possession of the Geological Society, is beyond doubt the remains of a tree-fern, and thus affords decided evidence that such plants formed part of the flora of the coal epoch, which, from their present localities, might have been supposed. It is therefore, at this time, a specimen of peculiar interest and importance; since recent investigations have rendered it probable that many of the fossil stems once thought to be the remains of arboreous ferns, belonged to plants of a different class.

(942.) Some of the fossil Selaginales are very similar to the *Lycopodia* of the present day, such as *Lycopodites falcatus*, which is an oolitic fossil, [§ 935, fig. B, C.] But the most numerous and remarkable Lycopodial remains are those gigantic fossils called *Lepidodendra*, [§ 935, A,] and *Ulodendra*, some fragments of which measure near fifty feet in length. These enormous moss-ferns, with their supposed fruits, called *Lepidostrobi*, with several species of *Lepidophyllum* and *Selaginites*, are common in the coal formation, and are supposed to have flourished in this epoch only, as they are found exclusively in the coal series. Their remains are wanting in all the superior strata, and it is only some few species of *Lycopodites* which more or less approach the Lycopodia of the present day that are found in the more recent beds.

(943.) The *Sphenophylla*, which Brongniart considered as fossil *Marsileaceæ*, and the *Stigmariæ* which he esteemed gigantic fossil *Isoetes*, a kind of monstrous aquatic quill-ferns, analogous to the immense terrestrial *Lepidodendra*, can no longer be associated with fossil-ferns, their affinities having now been satisfactorily traced to different orders.

(944.) Such are the principal facts hitherto discovered relating to the geological distribution of the ferns, and from them the following generalizations may be safely drawn. *First*, that in the oldest strata, in which land-plants occur, ferns are met with in the greatest abundance. *Secondly*, that their absolute numbers and relative proportions become wonderfully diminished in the superior formations, until, in the later series, they are comparatively scarce. *Thirdly*, that not only is their numerical strength astonishingly lessened, but that they are still more remarkably reduced in size.

What external physical influences can have wrought these changes? The effects are obvious, shall the cause for ever be unknown?

(945.) The study of fossil plants being as yet but an infant branch of botany,

all theoretical views are indulged with fear, and even simple generalizations are advanced with diffidence. And it is right that it should be so; for little more than 500 extinct species have been hitherto discovered, while there are proofs enough vegetation was formerly much more luxuriant than now, and that opportunities alone are wanted to extend the catalogues. The materials are abundant.

(946.) But although future researches may considerably affect conclusions founded upon present data, the variations will be rather in degree, than kind; for the extensive mining operations which for a long time have been carried on in this, as well as in foreign countries, have as it were accidentally revealed so many facts, that the chief inferences drawn therefrom, corroborated as they are in other ways, especially by phyto-geographical researches, can scarcely be set on side.

(947.) It will be remembered that the chief statistical and topographical generalizations which have been established by the researches of botanical geographers, are, *first*, that ferns are small in size, and few in number, both absolutely and relatively, in the temperate and frigid zones, if the vegetation of these extra-tropical latitudes be compared with that of the equatorial regions; in which their magnitude is greater, and their number more. *Secondly*, that small islands and low swampy tracts are more favorable to their development than extensive continents and lofty hills. And, *thirdly*, that if the atmosphere be moist, they will luxuriate amidst barren sand, or upon rocks almost destitute of vegetable mould; throwing out their foliaceous fronds, and even elevating their noble arboreous stems from the nearly naked stone, to which they are indissolubly bound by their clasping roots: when unsteadied by any depth of soil, their trunks can be shaken by the feeble force of the human hand.

(948.) The coincidence between these geographical and geological generalizations is obvious; and their tendency to corroborate the views suggested by similar inquiries, into the habits and distribution of extinct and existing algæ, no less remarkable than important: for thus, some hints, which at first seem vague, and views that appear chimerical, become, as they are gradually unfolded, more and more plausible; and if true, their truth can alone be finally established by the concurrent testimony afforded by analogous investigations into the physical conditions of other classes both of plants and animals.

(949.) Of the Equiseta that are found in a fossil state, *E. brachyodon* the most resembles our modern plants; but its resemblance is rather to our tropical than extra-tropical species: and several of the other fossil Equiseta exceed in size the largest indigenous in our torrid zone many times more than our largest equatorial exceed our smallest Lapland and arctic species. The same holds true with regard to the *Selaginales*; and in numerical proportion, if not indisputably in size, with regard to the frondose ferns. For, in relative numerical strength, the ferns in the coal era exceeded their representatives in the most favorable parts of our torrid zone more than equatorial ferns in the present day exceed those of the temperate and northern regions.

(950.) Now, as existing ferns are the largest and most numerous in our warmest latitudes and most moist localities, it is probable that, in those geological epochs in which they were much more prevalent and attained a larger size than now, even in the most humid parts of the torrid zone, the atmosphere was more moist and the temperature higher, even in the extra-tropical regions, than it is at present in islands under the equinoctial line.

(951.) As *Tæniopteris*, and other fossil ferns, which are found in the superior strata of our temperate latitudes, although dissimilar to any now existing, bear the greatest resemblance to the *Marattidæ*, which are exclusively tropical plants, growing in Jamaica and other similar hot localities, the atmospheres of which, from their insular condition, are necessarily humid, it is highly probable that, in the tertiary epoch, the climate of the now temperate regions resembled that of the torrid zone; that the temperature was at least as high, and the dampness great.

(952.) As the fossil floras of the secondary strata, and especially that of the coal formation, abound in ferns unlike any that now are known, and as they exhibit in excess those characters of numerical strength and enormous magnitude to which the vegetation of tropical islands affords the nearest approach, although it gives but a very faint conception of them, it is more than probable that the physical conditions now essential to produce arborescent equiseta, and arboreous frondose ferns, were then present in a degree as much exceeding that of our intertropical islands, as the relative proportion of ferns, and their size in the coal strata, exceed their size and number in the hottest and dampest parts of our torrid zone; and, if so, that the globe, in the epochs referred to, had much less land raised above the surface of the waters than at present; that the then highest lands of the vast eastern and western continents were islands in a boundless ocean; that the temperature of the earth was more equable and much higher than at present; that the air was irrespirable, and the atmosphere loaded with vapours.

(953.) The excess of watery surface, which it is demonstrable at one time existed, would very much tend to equalize the temperature of the islands which it is presumed were emerging from the bosom of the deep; and, although the evidence is not as yet complete, the theory of more equable temperature receives some confirmation from the fact, that the coal floras not only of North America and Europe are for the most part identical, the species being referrible often even to the same genera, but also that, of the few fossil plants brought from the coal strata of Baffin's Bay, New Holland, and Hindoostan, (*i. e.* from the northern, the southern, and the torrid zones,) the chief are ferns belonging to the same natural groups with those which predominate in the coal formations of central Europe: and uniformity of vegetation is one strong evidence of uniformity of temperature, as well as of other physical conditions.

(954.) That the atmosphere in this epoch was irrespirable by man, although merely adventured by Brongniart as a speculation, is not destitute of circumstantial evidence in its favour. The two chief arguments go to prove that the proportion of oxygen was once much smaller, and of carbonic acid much greater, than at present; and that the former has been increased, and the latter diminished, through the agency of plants, and perhaps principally of ferns.

(955.) The first of these propositions is countenanced by the more perfect state of preservation in which the fossil remains of plants are found in the old than in the newer strata; which could not have been the case had external physical circumstances in all these epochs been the same: and as the decomposition of dead plants, and their transformation into vegetable mould, is due almost entirely to the subtraction of a part of their carbon by the oxygen of the air, and as excess of carbonic acid would retard or prevent their decay, it is not improbable that their more perfect preservation in the older strata may be attributable to such a cause; further evidence of the existence of which will immediately be offered.

(956.) Below the coal series, and the strata immediately subjacent, in which land-plants first appear, no vestiges of mould are found; and yet the vegetation in this epoch was most luxuriant, and most profuse. Heat, as a constant stimulus, combined with moisture, would be a great incentive to inordinate growth: but whence was the solid matter derived which the plants assimilated? whence did they procure the enormous quantities of carbon which, supplied with such unbounded prodigality, successive generations formed into those vast beds of coal that are spread, in interrupted strata of variable thickness, from the arctic to the antarctic pole?

(957.) This is a circumstance which it is difficult to explain; and of the existence of the difficulty no doubt can be entertained, although, as Brongniart observes, it is a point which has hitherto excited far too little attention. "It is evident," continues he, "that the organized beings now in existence, both animals and vegetables, as well as the deposits of combustible fossils, bitumens, &c. of all ages, are composed of a large quantity of charcoal, which, before the existence of the beings that now contain it, and which have deposited it in the various strata, must have existed in nature in some other form, and in such a state, that they were enabled to assimilate it: and as no vestiges of charcoal, in a solid state and an assimilable form, is found below these strata, it is not unreasonable to suppose that the carbon was spread throughout the atmosphere in the form of carbonic acid; and that it was from this state that vegetables have from the first been labouring to convert it into fitting food for animals.

"It is well known, from the experiments of Saussure, that the proportion of carbonic acid now present in our atmosphere is far from being that which is most favourable to the growth of plants, and that a quantity much greater by two, three, four, or even eight per cent., renders their vegetation more active and vigorous when they are exposed to the influence of the sun. A larger proportion of carbonic acid than now actually exists in our atmosphere ought, therefore, to make plants not only more vigorous in their growth, but also more independent of a soil as yet sterile and charged with little mould, by allowing them to live almost entirely at the expense of the atmosphere." And such is known experimentally to be the case; for many plants, such as the *Grasses*, which derive little nourishment from the atmosphere, greatly exhaust the soil in which they grow; while others, with broad expanded foliage, such as turnips and mangel wurtzel, rather improve than impoverish it.

"This hypothesis of the presence of a large quantity of carbonic acid in the atmosphere at the epoch of the coal formation, without which it is impossible to conceive how any plausible explanation can be given of the origin of all the carbon which now is fixed in a solid form in organized bodies, both fossil and living, coincides perfectly with the well-ascertained fact, that terrestrial plants are of a more ancient date than air-breathing animals, to whom so large a quantity of carbonic acid would have been a deadly poison. Thus, it was not until after successive generations of plants had purified the atmosphere of its excess of carbon, and fixed it in the soil in the state of coal and of other combustible matters, that air-breathing animals, at first reptiles, and afterwards beasts and birds, were enabled to live on the surface on the earth. At this time there was brought about the state of equilibrium between the respiration of plants and that of animals which characterizes the present epoch, and which is perhaps one of the causes of the stability in the forms

of organic living beings; as the variableness of the atmosphere was not improbably one of the secondary causes of their former variability."

(958.) There seems to be a peculiar fitness in the selection of such plants as ferns, which will grow on the bare and barren rocks, and especially in selecting allies of the *Polypodia*, that derive their food chiefly from the atmosphere, to be the chief secondary means by which such great and beneficial works might be performed.

To have substituted grasses would have been useless, when there was no vegetable mould upon which they could subsist themselves, and none of those animals existed that they are required to sustain. Ferns, of which few are eaten by any animals, and which, as may be seen in the case of the common wall-fern, require no rich soil for their support, seem to be, of all other plants, the fittest for the purpose.

(959.) This theory, it is confessed, is in a great measure conjectural, and therefore it has been given nearly in its author's words; it is, however, very plausible, and not wholly gratuitous. It accounts for many things which are otherwise unaccountable; and, being based on established facts, it involves no apparent absurdity. It is a theory, or view, of certain facts; it may be false, but it appears to be borne out by our present knowledge. It was only given as an hypothesis, and it is quoted as nothing more.

Such a state of atmosphere will account for the luxuriant growth of plants without mould or sustaining soil; such a superabundance of carbonic acid well accounts for the better preservation of vegetable remains in the older than in the newer strata; and such a source is the most reasonable that can be conjectured as that from which the immense quantities of carbon could be derived, which, through the medium of vegetables, have been converted into coal.

If the atmosphere in these epochs was thus laden to excess with carbonic acid gas, it would be unfit for the respiration of any terrestrial animals now known; and there is negative proof that none such then existed, as no fossil remains of any have hitherto been found.

(960.) The office of the ferns and the other plants of the coal formation, and the final cause of their predominance in that period, would therefore seem to be that, by their assimilation of the carbon, and liberation of the oxygen with which it was combined, they might purify the atmosphere, and bring it into a condition in which it would become respirable by reptiles, beasts, and man. That such was the primitive condition of the atmosphere, and that it thus was gradually purified by the growth of plants, seems to be not improbable, from the circumstance that reptiles and other cold-blooded animals, which can endure and enjoy an atmosphere that would be fatal to warm-blooded animals and man, are the earliest of which any fossil remains are found. That the atmosphere at first was very greatly loaded with carbonic acid, is probable from reptiles not appearing until after the coal formation; and that it required many successive generations of plants to render it respirable for birds and beasts, is also likely, as it is not until long after that any vestiges of these animals are found.

These were the immediate precursors of the human race, the sovereigns of a world which they underprize, and of which they little know the wonderful structure and the surpassing beauty. It is science which can alone display the greatness of the works of creation; it is science which alone can truly tell how much fashioning this earth required to make it habitable by man.

OUTLINES OF GRAMINOLOGIA.

(961.) The grasses form one of those large and very natural groups of plants which, marked by strongly characteristic features, have been universally associated, and their affinity acknowledged by the learned as well as the simple. Science has here done little more than sanction and describe the boundary which untutored observation previously had traced: in some parts, however, it has been drawn anew and occasionally diverted, in order to render it consistent with itself.

(962.) Some of the grasses have been long celebrated for producing large seeds and very nutritious leaves, which for ages have formed the staple food of domestic animals and man. These have been called the *cereal* or *corn*, and the *pasture* or *fodder grasses*. Others are as remarkable for their destitution of these valuable properties, and are notorious for their meagre seeds and innutritious foliage. Hence they have been called *Carices*, from *careo*, to be absent, or to want. They are the sedges, or reed-grasses, of the farmer.

(963.) *Gramen* was formerly the common name for all the grasses. But, when they were distinguished into two orders, the corn and fodder-grasses were alone called *Gramina*, and the sedges were named *Calamariæ:* a collective term being sought from their several peculiarities of structure. Thus, by some they were denominated *Plantæ glumaceæ* or husk-flowered, and by others *Culmiferæ* or straw-stalked plants. But, as the restricted use of the word *Gramina* has long since fallen into neglect, and now become almost obsolete, the two orders being respectively called *Gramineæ*, and *Cyperöideæ*, or *Cyperaceæ*, by Jussieu, De Candolle, and others, the original Gramina may most advantage-

ously be restored to its former comprehensive signification, and again become the common collective designation of the whole.

(964.) Our English word *grass* is a very ancient one, and exists, with slight modifications, in all the Teutonic dialects; thus, in Anglo-Saxon, we find *Graes* or *Gaers*, in German *Gras*, in Danish *Gräs*, in Swedish *Gras*, and in Icelandic *Gras;* even in Greek there is γρασις, a word of exactly the same meaning, though ποα, ποη, or ποιη, are more commonly used.

Chloa (χλοα), another Greek name for *grass*, has given origin to the adjective χλορος, *grass-green*, whence *Chlorine*, and *Chlorosis*, are derived.

Gramen has been whimsically deduced *à gradiendo*, but seems rather to be connected with germen.

Agrostis, (Ἀγρωςτις from Αγρος, a field,) like the Saxon *ley* or *lea*, denotes the plants from the places in which they most abound.

(965.) The Gramina are the simplest of the truly flowering plants, and, from the comparative simplicity of their structure, they seem to invite the earliest consideration. They are readily distinguished from the previous class by bearing evident flowers, which flowers consist essentially of *ovules*, [§ 969, fig. *d*,] that when ripe become seeds; of *Pistilla* or pointals [*b*, *c*], and of *Stamina* or chives [*a*]: these parts are invested or covered by several series of modified leaves, called *Glumes* or husks, [§ 971, B, F,] and termed collectively a *perianth:* the glumaceous nature of the perianth is one of the most distinctive characters between the grasses and the following groups of flowering plants. From being the earliest instances in which true flowers are found, although simple in their structure, the morphology of the several parts is less clearly understood than in the more elaborate flowers and fruits of the subsequent classes: for, in them, the organs that are seen here in their primary or rudimental state, become further developed and more perfectly evolved.

(966.) The articulated, hollow Stipitellæ of the jointed ferns, bring them, in their organs of vegetation, the nearest to the cereal grasses of any of the ferns; and their organs of fructification, although very obscure, still, as it were by proxy, introduce the student to the more elaborate and distinct organization of the seeds, and their subservients, which are found in the superior grades. The fibro-vascular stems of the grasses remind the physiologist, both by their structure and their subterranean or creeping

habits, of the prostrate or subterranean Stipites of the ferns; and the culms or straws which spring from them are analogous to the Stipitellæ, or fronds, previously described.

Siliceous deposits similar to those found in the Equisetinæ, (and from which, as they injure the mouths of cattle, they have been called shave-grasses,) are likewise met with, but in a less degree, beneath the cuticle of grasses; and the leaves of one order of the Gramina, springing from the nodi and surrounding the stem with a sheath, bear a resemblance to the vaginal enclosures of the Equiseta which are found at every joint; or perhaps these annular sheaths are more analogous to the membranous processes or ligulæ at the bases of the leaves. Furthermore, certain arborescent grasses, as the bamboos, raise their stems above the surface of the earth, in like manner as do the arboreous ferns, and are met with in tropical countries, even exceeding many trees in height.

(967.) The internal structure of the subterranean stems of grasses, and that of their superterranean culms, consists of a mass of cells traversed by tubular vessels, some corpusculiferous, some false tracheæ, and some true spirals; which latter tubes were, in the previous class, either entirely absent or rarely found, or, if present, few in number, and in a very rudimentary condition. At each joint, whenever joints are found, the fibres interlace and form a solid knot, which remains, as it does in the Preles, even after the development of the neighbouring parts has formed, as in them, a cavity in each internodium. From the knots the leaves spring, and by their bases enclose the culm with a sheath-like expansion or vagina, which in the one order is *entire*, in the other *cleft* [§ 969, *c;* A]; the tubular vessels run in right lines, or nearly so, from the exsertions to the points of the leaves, without any interweaving or reticulation; at the lower part of the culms the nodes are usually much nearer together than in the upper; and from those which are beneath the ground, roots spring, which always regulate the supply of food to the plant as drawn from different depths; and, however deeply the seeds may be sown, will, if they grow at all, bring the chief roots as near the surface of the soil as those of seeds which have originally been placed at a proper depth. In the axillæ of the leaves, buds are likewise formed; those which are produced below the surface of the soil become developed, and serve to form the large tufts of culms for which the more prolific grasses are notorious. The increase by these offsets, which often

takes place to a vast extent, is called tillering: and hence it is that one grain of wheat will often produce twenty, thirty, forty, or even fifty, or one hundred culms, each bearing sixty, seventy, eighty, or one hundred grains; a most prodigious increase. A tuft of grass is thus very similar to a compound bulb, such as the garlic, the coats of which have been loosened or become obsolete. The general axis of the plant is abortive, and therefore all the leaves and flowerstalks, which indeed form the culms or branches, are sessile on the subterranean rhizoma. Often the rhizoma, still prostrate, is lengthened, as in the *Irises* and the *Ferns*, and the culms or branches spring up at intervals from the nodi, as in the plants referred to, while again, on the other hand, the rhizomata occasionally become erect, and arborescent, like both palms and pines; and, when the aerial buds are developed in the axillæ of their leaves, they are even furnished with branches, as in the bamboos.

(968.) The grasses have been said to be less truly *endogenous* than any other monocotyledonous plants. This assertion is, however, scarcely correct, and probably arose from not sufficiently attending to the distinction between the *culms* or *branches*, and the rhizomata or true stems; for the underground stems, even of the herbaceous grasses, have the unstratified structure of the palms and ferns; and as to the internal similitude of the arboreous stems of the bamboos there can be no doubt. Their external conical form, resulting from the development of their lateral buds as branches, is, however, an important deviation from the normal appearance of the *Endogenæ*, and is probably alluded to by Agardh; but even this aberration is not peculiar to the grasses.

(969.) The fistulous culms in one order cause the tubular vessels to be arranged in a circle round the central cavity, as in the Stipitellæ of the Equiseta; but even in them the whole at first was solid, and the inter-articular vacuity is caused by the growth of the fibrous tissue being more rapid than that of the cellular parenchyma; to which parallel instances might be cited from other Endogenous and Exogenous plants; as the common onion, the hemlock, and most umbelliferæ. In the sedges, the culms, which in the other grasses become hollow, always remain solid, and, at the imperfect nodi which occasionally are found, there are no diaphragms, so that they would seem to have been arrested in the progress of their development, or to be forerunners of their

more highly developed associates. That the sedges are the least perfect of the two orders into which the Gramina have been distributed is evident, not only from the structure of their mature stems being analogous to that of the infant form of their allies; but also

Carex pendula.

Upper part of the culm, shewing the superior position of the Staminiferous spikes and the inferior of the Pistilliferous ones, the linear venation of the leaves, the entire sheaths, and the absence of ligulæ.

(*a*) Staminiferous flowers, with erect innate anthers.

(*b*) Pistilliferous flowers enlarged, to shew the germen or ovary style, the three plumose stigmata, and the keeled bracteæ.

(*c*) The double scale at the base of the fertile flower.

(*d*) The fruit enlarged, and cut transversely.

from the much more rudimental state of their floral organs; the modified leaves or bracteæ, which are external to the essential parts, being in fewer series, and often reduced to the condition of hairs or bristles. These, and other important differences in structure, have led botanists to confirm the popular division of the grasses into two orders, the *Cyperöideæ* and *Gramineæ* of Jussieu, the *Cyperaceæ* and *Gramineæ* of De Candolle, the *Cyperales* and *Graminales* of the present system.

(970.) Although the culms or branches in the *Cyperales* or sedges are knotless, their true stems or rhizomata have nodes, which become occasionally swelled into tubers [§ 984, B]; and, as the leaves and flower-stalks both spring from the crown of the root, the latter resemble the scapes of many bulbous plants, or are rather analogous to the upper parts of the culms of the Graminales, in which the nodes become more and more distant, and the internodia lengthened, until the inflorescence begins, when the axis is again reduced, and the modified foliage converted into flower and fruit.

As the more important organs which are common to both orders are most easily demonstrated in the latter, the following detail will refer especially to the Graminales, and the peculiar characteristics of the sedges will be subsequently described.

(971.) Towards the upper part of the culm in grasses where the nodes are more distant, and the internodia lengthened, the leaves become much smaller, and are at length so far contracted

A. *Avena sativa.* (*a*) Panicle of flowers, with a locusta separate. B. One flower separated. (*a*, *a*) The two valves of the glumelle. (*b*) The stamina. (*c*) The pistil. (*d*) A stamen separate, to shew its filament and anther. (*e*) The pistil, separate. (*d*) The valves of the glume. D. The lower, and E the upper, part of the culms of *Oryza sativa.* F. A flower shewing (*a*), the two glumes, and (*b*), the two glumellæ. G. A flower with the husks removed, shewing (*a*, *a*), the six stamina. (*b*) The two pistils, at the base of which are the glumellulæ or nectary scales.

and changed in appearance, that their names are also changed: they are called *bracteæ*, or more commonly glumes (glumæ), or husks. Within these glumes, when present, are contained the organs of reproduction.

(972.) These glumes or husks, consisting of one or more *bracteæ* or *valves*, sometimes called *Spathæ*, either spring immediately from an undivided culm (a simple axis) or *rachis*, when they are said to form a *spike*, or, if stalked, a *racemus;* when they are set more or less diffusely on a branching axis or compound rachis, they are said to form a *panicle*, which may be either co-arctate [§ 971, fig. E,]

or diffuse, [A.] Each division of the spike or *panicle, i. e.* the collection of two or more florets in the glume, is called a *spikelet* (spicula) or locusta, [§ 971, fig. A, *d*, F.]

(973.) The spikelets or locustæ may either be one, two, three, or many flowered; the inner and finer bracteæ are called the *glumellæ*, [§ 1005, *k*,] and the valves or pieces of which they are composed, *paleæ* or *spathellæ*. Within the Glumæ and Glumellæ are found, in general, two smaller scales, [§ 1005, *m*,] which have been called the *Glumellulæ*, *Spathellulæ*, or *Lodicules*; and these immediately surround the fruit. The Gluma is called a calyx, the Glumella a corolla, and the Glumellula a nectary, by Linnæus and Smith.

(974.) Formerly these three series of coverings were likened to, and named after those organs in more highly developed plants, towards which they are transitions from ordinary leaves; but, as they are distinct in character, it is better they should have also different names; and their analogy to calyx, corolla, and nectary, is quite as evident now that the Glumes, Glumelles, and Glumellules, are considered what they are, viz. gradations of bracteæ, as when they were assumed to be what they are not, viz. *sepals*, *petals*, and so forth.

(975.) From the valves of the glumes and the glumellules are sometimes continued thin hair or thread-like processes, which, if they are evident continuations of the nerves of the bracteæ, and are exserted from the margin, are called *bristles* (setæ); if they are not, but arise from the base of the glumes, or leave the expansion before arriving at the edge, they are called awns (aristæ,) [§ 1005, c, *c*, *l*.]

(976.) Those organs, which in the ferns are only evident after the granules begin to vegetate, and which are probably in them *produced*, not *educed* by germination, exist in the fruit of the grasses previous to its separation from the parent plant, and constitute the contents of these fruits, true seeds of that kind called *grains*, whence these vegetables have been by some denominated *grain-bearing* or *graniferæ*.

(977.) The divisions of the rachis or extremity of the common axis, which bear flowers, are called *peduncles (pedunculi,)* or flower-stalks, and the ends of the peduncles or the points of the rachis whence the flowers spring, are called *receptacles*, *thalami*, or *bases*.

(978.) The organs previously foreshadowed, but here present, are,

first, the *chives* or *stamina*, which are situated within the *Glumelles*. They consist of a thread called a *filament* (*filamentum*,) which supports a two-celled case or theca, called an *anther* or *summit*, within which are numerous small cellules, termed *pollen*, each of which is a minute membranous bag, containing a substance of different degrees of fineness and tenacity, which has been named the *fovilla*.

(979.) In some florets no further organs are found, and such florets are termed staminiferous or barren [§ 969, fig. *a*]; but in other flowers a central body is perceived [§ 969, *b*; 984, *h*], called the Pistil or Pointal, from its occasional *pestle* shape and occasional pointed extremity. The base of this pistil is in general tumid, and is called the *germen* or *ovary*; from it rises a column of greater or less extent, denominated the *style*, which is crowned by a capital named the *stigma*. Sometimes the style is absent, and then the stigma is said to be *sessile* on the ovary. If the floret contains a pistil only, it is said to be a *Pistilliferous* or pistil-bearing flower; and, when both stamens and pistils arise from the same receptacle, the flower is said to be mixed or united. With regard to relative situation, the stamens, when in the same flower with the pistils, are exserted from the rachis or receptacle below the germen; and this disposition is said to be hypogynous.

(980.) The germen or ovary, which becomes the fruit, consists of an ovule or ovules, which are the rudiments of future seeds, and of an outer covering named the pericarp, which in the cereal grasses adheres very closely to the seed; the fruit hence receives the name of *caryopsis*, a word (derived from καρυα and ὄψις,) signifying a resemblance to a seed, in reference to the obscurity of this seed-vessel leading many to suppose it to be absent, and to believe the seed to be uncovered. In the sedges the pericarp does not adhere to the seed, and hence their fruit is called an Achenium. When, during the economical process of converting corn into flour, the pericarp is separated by mechanical means, it constitutes bran.

(981.) The seed consists of several other parts, some of which are only in a rudimentary state in grasses; and hence their description shall be deferred until they are more fully evolved. The other organs which now need demonstration are, first, a minute body called the *Embryo* or *plantule*, and a reservoir of food laid up for its support during the infantile period of its growth, which bag of starch is called the *Albumen*, [§ 984.] Sometimes it includes the embryo, at others the embryo is free.

(982.) The embryo itself consists of one, or rarely two half-leaf-like scales, which are called *cotyledons*, and of a gemmula, and a radicula, minute organs destined to become the future stem and root. In the grasses, the radicula is enclosed in a sheath, which is called the root-case or *Coleorhizon*, and all plants which have the radicule thus enclosed are termed *Endo*-rhizous.

(983.) These are all characters of importance in the systematic arrangement of the plants in which they are found, for by the most general ones the Gramina are associated with the other classes to which they are naturally allied, and by modifications of the more special ones they are distributed into orders, sections, types, and genera, analogous to the divisions that have been illustrated in the preceding groups.

CYPERALES.

(984.) This order includes all those grasses or grass-like plants in which " the embryo is within the Albumen, one or more series

A. *Cyperus rotundus*. (*a*) Lower part of the stem. (*b*) Sertulate inflorescence. (*c*) Tubers formed by hypertrophied underground culms. (*f*) Bracteæ or glumes, side view. (*d*) Back view. c. Carex arenaria, shewing its creeping stem, imbricate glumes, and spicate inflorescence. (*g*) Glume. (*h*) Essential organs of the flower, viz. stamina and pistil, shewing its ovary, style, and three stigmata. (*e*) Imbricated glumes of Carex hirta. Unlettered figure, a section of the seed of Scirpus supinus, shewing the Albumen, including the Embryo.

of the glumaceous perianth suppressed, the leaf sheaths entire, and destitute of ligulæ, and the culms solid, angular, and knotless." The absence of nodes from the stems of the sedges, if not absolutely universal, is very nearly so, and, from the facility of application, this has long been one of the most popular diagnostics. Among the Romans its acknowledged truth gave rise to the common proverb, 'nodum in scirpo quæris:' in scirpus sylvaticus, however, imperfect knots are found. Although differing in the above characteristic particulars, the *sedges* (Calamariæ of Linnæus,) agree with their immediate allies, the grasses, in the husky nature of the bracteæ that form their floral integuments, which are hence called *glumes* in both orders; the outer bracteæ of each floret or spikelet is, in the sedges, always solitary, *i. e.* they have one-valved glumes which overlie each other like gutter-tiles, and hence in their disposition said to be *imbricated*, [§ 969 and 984.] From the axillæ of the glumes the stamina, variable in number, but generally three, and the pistilla usually arise, sometimes uncovered by any further floral integuments, sometimes with the inner bracteæ, *Spathellules* or *Glumellules*, developed in the form of bristles (*setæ*,) and even evolved as scales (*paleæ*) like the Spathellules of the grasses; yet even here the Glumellule consists of only a single valve, or, if of two, they are united, as in Carex, [§ 984, *g*.]

(985.) The florets, as in the other grasses, may be either staminiferous, pistilliferous, or united, and the stamens and bracteæ, being all seated below the germen, are said to be, as before explained, hypogynous. In some of the sedges, the separated florets grow on the same plant, although the stamens and pistils are not in the same flower, when they are said to be monœcious, or dwelling in one house: at other times the separation is still more complete; one individual plant, bearing only staminiferous florets, and another of the same species only pistilliferous, when they are said to be dwelling in two houses, or to be *diœcious*. The germen contains a single ovule: hence the ovary is one-seeded, (or monospermous,) and the seed-vessel (pericarpium) being separable from the seed, is called an *achenium;* occasionally the valves of the glumelle are persistent; and, if they become partially succulent, the fruit has been called, though improperly, a subdrupaceous achenium. The seed is erect in its pericarp, and consists of an albumen, which, from its surrounding the embryo, is called perisperm.

(986.) This order contains two sections, which differ in having

the one united, the other separated flowers. From the normal genera, *Cyperus* and *Carex*, these sections are named the *Cyperinæ* and *Caricinæ*.

CYPERINÆ.

(987.) The genera included in this section are indicative of two grades of development, and hence they are distributed into two types. In the paper-reed (*Papyrus*), the Galingale (*Cyperus*), and their immediate allies, the united florets are destitute of glumelles; while in the rush-sedge (*Scirpus*,) the wool-bearer (*Eriophorum*,) and others, the flowers, although still united, differ in having the glumelles present, with form of hypogynous hairs or bristles, of different lengths, with which the germen is surrounded. These two types are called the PAPYRACEÆ and SCIRPACEÆ, from *Papyrus* and *Scirpus*, the most familiar examples they respectively afford.

(988.) PAPYRACEÆ. The *Papyrus antiquorum* is a plant of classical celebrity; as from it the Egyptian *papyrus*, and the chief of the paper used by the ancients, was procured; and the manufacture, though now obsolete, was continued to the beginning of the eleventh century. *Babeer*, the Syriac name, is said to be the root of the Greek and Latin words παπυρος and *papyrus*, and of the English *paper*. The former uses of this plant were many. Antigonus is recorded to have had the ropes and cables of his fleet made from the stalks. Pliny says that boats were constructed of it, and Bruce confirms this statement; for he says that in Abyssinia they have no other vessels. The Papyrus is indigenous to Ethiopia and Egypt, and, although generally preferring stagnant waters, Bruce found it growing in the rapid course of the Jordan; and he there remarked that it constantly opposed one of the angles of its stem to the current, as if to elude the violence of the waves. The roots of papyrus were chewed for the pleasant juice they yield, and the Egyptians used to roast their stalks, and eat the soft pulpy matter they contain. Matthiolus recommended the introduction of small portions into fistulæ as tents.

(989.) *Cyperus* is a very large genus, containing upwards of 250 known species, very few of which are either esculent, or of much value as medicines or in the arts.

C. esculéntus (the *Souchet comestible* of the French,) bears tubercles about the size of nuts on its underground stem, that are

replete with starch; and in many places, as in Egypt and Manilla, they are much eaten. When roasted, they have been used as a substitute for coffee. *C. longus* and *rotundus* are both good stomachics. The roots of the former have a pleasant smell of violets, but they are too bitter to be eaten in any quantity. One of these plants is said to have been the κυπειρος of Dioscorides; and, from its reputed aphrodisiacal powers, it received its name. Major General Hardwicke states, that the roots of C. rotundus have been given with benefit in cholera: the native practitioners call it *Mootha-ghas*. *Nagur-mootha*, the roots of which the Indian damsels use for cleaning and perfuming their hair, is the *Cyperus perennis*. *C. juncifolius* is said by Ainslie to be both diaphoretic and diuretic; and *C. articulatus* is esteemed in Guinea as a vermifuge. The nut-grass of the West Indian planters is the *C. hydra*. This plant is the pest of the sugar-grounds, as it overruns them, and renders the canes barren. The subterranean tubercles of various species of Cyperus, especially *C. esculentus*, contain a considerable quantity of oil, to which they owe their nutty flavour and fragrant smell.

(990.) *Schœnus*, derived from σχοινος, a rope or cord, because from these plants cables and cordage once were made, is a generic name now given to a large group of sedges of no very great economical importance: they abound on the banks of water-courses, and in wet cold lands, and thus afford a scanty pasturage where better grasses will not grow. *Schœnus* or *Cladium mariscus* flourishes in vast profusion in the fenny parts of Cambridgeshire: there hundreds of acres may be seen covered with this plant, and with it all the fires are constantly lighted in Cambridge, and in the neighbouring towns.

(991.) Scirpaceæ. *Scirpus*, another large genus, includes the bullrush (*S. lacustris*), with many other rush-sedges, some of which, such as the *S. maritimus*, that grows abundantly in the salt marshes, are much relished by cattle. *S.* or *Eleocharis cæspitosus*, the deer's-hair turf, forms, according to Hooker, the principal food of sheep and kine, in the Scottish highlands, for about three months in the spring of every year. *Scirpus tuberosus* is the *Pi-tsi*, or water-chesnut, of the Chinese: it is there cultivated in tanks, which are regularly manured, and the water at intervals drawn off. The tubers are eaten both raw and cooked, and are esteemed both as food and medicines. Withering says

that the roots of our *S. maritimus* are esculent, and that they have been ground, and used instead of flour, in times of scarcity. The leaves of several of the sedges are employed under the names of rushes, especially the *S. lacustris* or bull-rush, for making chair-bottoms, matting, and other domestic purposes.

(992.) *Eriophorum*, the cotton-grass or wool-bearer, is very common on most of our bogs and moors. Several of the species are very elegant plants, bearing in their spikes of flowers long tufts of silky-looking hairs. In Lapland this vegetable silk is woven into various fabrics, and it is used, both there and elsewhere, as stuffing for mattresses and pillows. *E. polystachion*, the bog-flax, is a popular remedy in cases of epilepsy.

(993.) The types *Scirpaceæ* and *Papyraceæ*, which differ in the presence and absence of rudimentary glumelles, the latter having none, and the former having them in the state of hairs or bristles, are associated to form the section *Cyperinæ*, their united flowers being the common collective sign.

CARICINÆ.

(994.) In *Carex*, *Trasus*, *Kobresia*, and *Uncinia*, the flowers are separated; the stamina and pistilla being situated in different flowers, either on the same or on different plants; the glumelles also, which in the *Cyperinæ* were either wholly absent, or only produced in the form of hairs, are here developed as true valves, which in Carex invest the germen, and, being persistent, afford it an adventitious tunic.

(995.) Caricaceæ. *Carex* is the largest and most important genus included in this type, which stands alone in the section *Caricinæ;* the distinctive characters of which are common to both. The Carices are for the most part homely looking plants, growing chiefly in wet and swampy soils: they are the especial inhabitants of bogs, fens, marshes, and moist woods, where they yield a very coarse grass, that is sometimes resorted to in scarce seasons, and in barren situations, as fodder for cattle. Their chief value consists in their flourishing in tracts on which no other, or at least no richer grass, would grow. The chief economical purposes to which the Carices have been applied, are as coverings for the Florence oil and wine flasks, and to put between the staves of casks, to make them tight. Carex leaves form the common ligatures with which hops in Kent and Sussex are tied to the poles; and

in Lapland the leaves of Carex sylvatica, and perhaps some other species, are combed and dressed as flax is in this country, and used as a warm lining or stuffing for gloves and shoes; and Linnæus says that, thus protected, the limbs of the Laplanders are never frost-bitten, notwithstanding the severity of the climate.

(996.) The roots of *Carex arenaria* are reputed to be diaphoretic, and to be possessed of demulcent and alterative powers. They are collected on the continent, and known under the name of German sarsaparilla. The roots of *C. disticha* and *hirta*, which have similar qualities, are mixed with those of *C. arenaria*, and are administered with advantage in rheumatic and cachectic affections.

(997.) The *Caricinæ* and *Cyperinæ*, which differ in having the latter united, and the former separated flowers, agree in the more general characteristics pointed out in [§ 984], and form collectively the order Cyperales. The Linnean term *Calamariæ* is untenable, as the genus *Calamus* is a palm, and none of the sedges are reeds: and De Candolle's modification of Jussieu's Cyperoideæ is objectionable, as having the termination, which is here, for the sake of perspicuity, restrained to the subordinate types.

GRAMINALES, OR POALES.

(998.) The *true* grasses, as they are sometimes called, to distinguish them from the *sedges*, (which, although *grasses*, do not fatten,) are well characterized as an order, by the reverse development of almost every part, the general structure of which associates them with the Cyperales. Thus, in the Graminales the culms are round, hollow, and jointed, instead of being angular, solid, and jointless; the leaf-sheaths are slit and furnished with ligulæ, instead of being entire and exligulate; the bracteæ are developed in several series, and evolved as perfect glumes, instead of being few in number and in a rudimentary state; the pericarp is adherent to the seed, so that the fruit becomes a caryopsis, instead of being separable and forming an achenium; and in the last place, the lenticular embryo is external to the albumen, instead of being enclosed within it.

(999.) These strongly marked features, which associate the true grasses to form the order Graminales, and distinguish them so clearly from all other plants, render their subordinate distribution into types and sections more difficult than in other groups where less

uniformity prevails, and in which, though the general characters agree, their agreement is less exact. It may however be observed, that for some of the most important purposes of natural arrangement, such as the predication of the properties of unknown plants, subordinate distribution is less necessary and of less consequence in the Graminales than in other orders of equal extent, where vast differences occur in the habits, qualities, and uses of the minor groups they comprehend; for here the greatest similarity pervades the whole. Thus, all the genera afford food to animals; the leaves form pasturage for cattle, the smaller seeds are the chief support of birds, and the larger the staple sustenance of man: and, out of nearly two thousand species, scarcely more than one is really unwholesome.

(1000.) The Graminales have been popularly distinguished into corn and fodder grasses (*Gramina cerealia et pascualia*); but these, although useful distinctions in an agricultural point of view, as indicating the chief purposes to which the multitudinous species are applied, are not founded upon any structural differences, and therefore, as systematic sections, cannot be adopted or defended.

Many of the present cereal grasses once yielded seeds unfit for food; and several of those now used for pasture only might have their seeds converted into corn; indeed, some, as the *Zizania fluitans*, will probably before long be naturalized to this country, and change our marshes into corn-fields.

(1001.) But, although not essentially necessary, on account of difference in properties, to distribute this order into minor groups, it is convenient, for practical purposes, that some subordinate distribution of the genera should be made. Many schemes have been proposed, but it is doubtful whether any hitherto devised will be generally adopted. The sections recommended by Dr. Brown are unobjectionable as far as they go; and, when more ample details than have yet appeared are published, his plan may probably supersede the one here given, which has chiefly its simplicity to recommend it.

(1002.) According to the views of Brown, the true grasses should be distinguished into two large groups or sections, one of which, from the genus *Poa*, or meadow-grass, he calls *Poaceæ*, and the other, from the genus *Panicum*, he terms *Paniceæ*. The Paniceæ are to be known "by having always a locusta of two flowers, of which the lower or outer is uniformly imperfect, being either staminiferous or neuter, and then not unfrequently reduced to a single valve." "The second tribe, *Poaceæ*, is more numerous than Paniceæ, and comprehends the greater part of the European species, as well as certain less extensive genera peculiar to equinoctial countries; it extends also to the highest latitudes in which phænogamous plants have been found: but its maximum appears to be in the temperate climates considerably beyond the tropics. The locusta in this tribe may

consist of one, two, or many flowers, and the two-flowered genera are distinguished from the Paniceæ by the outer or lower floret being always perfect, the tendency to imperfection in the locusta existing in opposite directions, in the two tribes. In conformity with this tendency in *Poaceæ,* the outer valve of the perianthium in the single-flowered genera is placed within that of the gluma, and in the many-flowered locusta the upper flowers are frequently imperfect. There are, however, some exceptions to this order of suppression, especially in *Arundo Phragmites, Campulosus,* and some other genera in which the outer flower is also imperfect; but as all of these have more than two flowers in their locusta, they are still readily distinguished from *Paniceæ.*" (*Flind. Voy. App.*)

(1003.) Link, Kunth, Bartling, Palisot de Beauvois, and others, have constructed various systems for the subordinate distribution of the grasses; and, although the question has not been settled by their labours, they have collected materials which will be of the greatest use to all systematic graminologists. The method proposed by De Beauvois is very ingenious, but it is too artificial for a natural arrangement, and less simple as an index than the Linnæan clue.

As the plans of the three former are more natural than that of the latter, it is therefore upon them, especially upon Bartling's, that the following distribution has been founded.

(1004.) The most familiar of the grasses, and the best known, from their value, are undoubtedly the Rice (*Oryza*), the Wheat (*Triticum*), the Barley (*Hordeum*), the Oat (*Avena*), the Rye (*Secale*), the Maize (*Zea*), the Millet (*Sorghum*), and the Sugar (*Saccharum:*) and these, together, form a constellation that no other order in the whole vegetable reign can equal in importance.

The above, which are the chief of the cereal grasses, with the *Bamboo* (Bambusa), the bread-grass (Panicum), and various pascual genera, such as (*Agrostis*) the bent-grass (*Stipa*), the feather-grass (*Festuca*), the fescue-grass (*Phalaris*), the canary-grass, and (*Spartina*), the rope-grass, are examples of the several groups into which this order may be conveniently distributed, and some of them, as normal genera, give names to their respective types and sections; but it must be remembered that, although convenient divisions of an extensive order, they are not separated by any such decisive and notorious signs as to supersede the value of an artificial clue, or to make the reference of individuals to their types and sections always easy to those who have no other index to guide them in their investigations.

TRITICINÆ.

(1005.) *Triticum* (the especial *Granum tritum*), which Varro says received its name from the mechanical process of grinding, to which the seeds were subjected before being used as food, not improperly denominates the section, in which, besides the wheats, there are contained, barley, rye, and lyme-grass; and to which the millet, the panic, and the sugar, are nearly allied, although in another section.

(1006.) HORDEACEÆ. *Triticum* (wheat), *Hordeum* (barley), *Secale* (rye), *Lolium* (darnel), *Elymus* (lyme-grass), and numerous other genera, in which the sessile, locustæ, or spikelets, are crowded into terminal spikes; and the styles, in number two, form, collectively, the type *Hordeaceæ.*

A. Root and lower part of the culm of Triticum hybernum. (*a*, *b*, *c*) Leaves with split vaginæ or leaf-sheaths. (*d*, *f*) Nodi. (*e*) An internodium.

B. Upper part of the culm, shewing the spicate inflorescence. (*g*) A locusta or spikelet of T. Spelta. (*h*) The glumes. (*i*) The glumelles. (*k*) A flower of T. hybernum, shewing (*l*), the three two-celled versatile anthers. (*m*) The germen or ovary, with the two glumellules or nectaries, and (*n*) the two pistils.

C. *Hordeum distichon.* (*a*) The culm. (*b*) The leaf. (*c*) The spike of locustæ. (*d*) A flower separate, to shew the awn. (*e*) The stamina. (*f*) The pistils. (*g*) A flower magnified, to shew the three stamens with versatile anthers, one dehiscing and disclosing the pollen. (*h*, *h*) The two pistils. (*i*) The plumose stigmata. (*k*) The germen or ovary.

(1007.) Wheat, (*Triticum,* [§ 1006, fig. A, B,] which is the principal bread-corn of most European nations, has been so much changed and improved by culture, that its connexion cannot be satisfactorily traced to any species of the genus now known to be growing wild. This, as well as our other cereal grasses, came to us from the east: and it has been asserted that the original stock still exists wild in Thibet. The testimony, however, is far from being conclusive. Wheat appears to be peculiarly sensible to the effects of soil and climate, for in different countries, and even in different parts of this island, the crops and their products are very various. Sicilian corn contains more nutritious matter than any grown in Britain, and Middlesex wheat is more nutritious than that grown in our northern counties. In Davy's Agricultural Chemistry a table has been drawn up, which very clearly illustrates the influence of soil, disease, and climate, upon the nutritive properties of corn, as well as shewing the superiority of wheat over the other cerealia: from it the following are extracts.

Whole quantity of nutritive matter in 1000 parts of each of the following grains:		Mucilage or starch.	Saccharine matter.	Gluten or albumen.	Extract or insoluble matter.
Middlesex wheat	955	765	—	190	—
Spring wheat	940	700	—	240	—
Mildewed wheat (1806)	210	178	—	32	—
Blighted wheat (1804)	650	520	—	130	—
Sicilian wheat, thin skinned	961	722	—	239	—
———, thick skinned	955	725	—	230	—
Wheat from Poland	950	750	—	200	—
North American wheat	955	730	—	225	—
Norfolk barley	920	790	70	60	—
Oats from Scotland	743	641	15	87	—
Rye from Yorkshire	792	645	38	109	—
Common beans	570	426	—	103	41
Dry peas	574	501	22	35	16
Potatoes	260 to 200	200 to 155	20 to 15	40 to 30	— —

The chemical analyses of which this table gives the average results, shew that wheat not only exceeds other corn in the absolute quantity of nutritive matter it contains, but that the different proximate principles vary remarkably in their relative proportions, and the superiority of wheaten bread depends upon the large quantity of *gluten* that its flour contains. When separated by washing from the starch with which it is combined, gluten comes into the market under the name of Maccaroni, Vermicelli, &c. In Italy, and especially in Naples, there are immense quantities manufactured both for exportation and home consumption. It forms the ordinary and favorite food of the poorer classes in Italy, especially in the Neapolitan states; and Maccaroni is sold by the yard, at the corners of almost every street in the city of Naples. There is another advantage of no slight economical importance that wheat possesses over other grain; which is, that not only does its flour contain more nutritious matter, but that it yields a greater quantity; for fourteen pounds of wheat yield thirteen pounds of flour, while fourteen pounds of oats yield only eight pounds, and an equal quantity of barley but twelve pounds.

(1008.) Of other species of wheat, *T. junceum* is worthy notice from its natural uses in fixing loose sands; and *T. repens*, the couch-grass of the farmers, which is here regarded as a troublesome weed, is collected on the continent as food for horses. Cattle of all kinds are fond of the underground shoots of this plant, which are sweet and wholesome. Sir Humphry Davy found them to contain nearly three times as much nutritious matter as the stalks and leaves; and it has been stated, on the authority of a French veterinary surgeon, that exhausted and worn out horses are very speedily restored to strength and condition, by giving them, daily, one or two bundles of couch-grass of ten or twelve pounds weight each, mixed with carrots.

(1009.) *Hordeum*, barley, [§ 1006, fig. c], is said to have derived its name from *hordus*, heavy, as bread made from barley-flour wants that lightness and elasticity which the large quantity of gluten it contains gives to wheaten loaves. The Romans cultivated barley, as we do oats, for the food of horses; but they likewise ate it themselves, and it was considered to be such a strengthening food, that it was regularly supplied to the army; and the gladiators, when training, were fed upon it: hence indeed they were called *Hordearii*. The word barley is evidently

derived from *beard* and *ley;* and the name alludes to its beard-like awns: yet it is curious that the Hebrew for barley is בר; and that the Celtic, *bara,* signifies bread.

Barley is chiefly grown in this country for the use of the brewer and distiller, for the saccharine matter it naturally contains is much increased by the process of malting; and the sugar is subsequently converted into spirit. On the continent it is still grown as provender for horses. When barley has been decorticated it is said to be pearled; and its various preparations form a light food for the sick chamber.

Hordeum murinum, the wall-barley, or squirrel-tail grass, which grows so freely in all waste places, if allowed to insinuate itself into meadows, injures the hay, and lessens the value of the crops. Its strong beards or awns hurt the mouths of horses so much, that in the Isle of Thanet, where it is very common, it is said to be one of the greatest recommendations of an inn to have hay without squirrel-tails or beard-grass.

(1010.) Of the genus *Secale* there is but one, or at the most two, known species. *S. cereale* is the common rye, [§ 540, fig. E, D.] The name Secale is thought to be derived from *seco* (*secabilis,*) and to have allusion to its early subjection to the sickle, and, next to wheat, it is one of the most serviceable bread-corns. It is less nutritious than wheat, but it is both hardier and earlier, and will grow in many wet cold soils, where no other corn would yield a remunerating crop. From this habit, it is more liable to be attacked with the ergot than other grasses, and becomes then injurious, if eaten for any long time together, [see § 540, et seq.]

(1011.) *Lolium* or Darnel is a very common grass, and several species, as the *arvense, perenne,* &c. have been recommended to be sown among other grasses on poor cold soils; it affords a bulky crop of hay, and, although much less nutritious than the Fiorins and various others, it is more so than the fox-tail, cocksfoot, dogs-tail, and fescue grasses. And it is not unimportant for agriculturists to be aware, that experiments have shewn some of the grasses to contain two or three times as much nutritious matter as others. The following extract from Sir Humphry Davy's table, already quoted, will furnish several examples.

Meadow foxtail (Alopecurus pratensis)...............	33	
Darnel or ray-grass (Lolium perenne)	39	
Fertile meadow-grass (Poa pratensis)	78	
Crested dog's tail (Cynosurus cristatus)	35	Parts of
Spiked Fescue (Festuca loliacea)	19	nutritive matter
Sweet-scented soft grass (Holcus odoratus)	82	in a 1000.
———————— vernal (Anthoxanthum odoratum...	50	
Fiorin (Agrostis stolonifera)	54	
Fiorin cut in winter	76	

(1012.) The *bearded darnel* is generally supposed to be the "infelix lolium" of Virgil, of which he speaks in no measured terms of condemnation. It is not a

very common grass in Britain, but in warmer climates it is a noxious corn-weed, and, with the barren oat, overtops and chokes the wheat; so that Milne thinks it

Lolium temulentum cuttings, to shew the fibrous roots springing from a short rhizoma; the split-leaf sheath with its ligula and the linear venation of the leaves: and the spike of inflorescence bearing several sessile locustæ.

(*a*) A locusta removed.

(*b*) A portion of the rachis, to shew the single glume or bractea.

(*c*) A single flower with its two glumelles, awn, or arista, and three stamina with versatile anthers.

(*d*) The pistil removed, shewing the double ovary and two stigmata.

(*e*) A section of a seed, to shew the albumen or perisperm, and the embryo with its single cotyledon outside of the albumen.

highly probable that the Greek *ζιζανια,* which occurs in the thirteenth chapter of St. Matthew's Gospel, should be rendered *Darnel,* which would convey the meaning of the passage more fully than *Tares :* and, in accordance with this view, the French always translate it *ivraie,* from *ivre,* drunk. Our partiality for contractions has caused the corruption of the French ivraie into *ray*-grass, one of the names of darnel, although it properly applies to one species only, viz. the L. temulentum, which is said to possess intoxicating powers. Haller affirms that this species of Lolium not only produces intoxication, as its trivial name implies, but that, if baked into bread, or fermented in ale, its administration is attended by very disagreeable, and even fatal effects. It produces headach, vertigo, vomiting, lethargy, drunkenness, and difficulty of speech, and the tongue exhibits a very strong trembling. Seager further remarks, that a trembling of the body is one of the most certain signs of poisoning by this plant. It also affects with blindness for several hours, which peculiarity is noticed by Ovid, in his Fasti, (lib. i. 692.)

> "Et careant *loliis* oculos vitiantibus agri
> Nec sterilis culto surget avena solo."

This property gave rise to the old proverb, "he feeds on Darnel," which was applied to a short-sighted imprudent person; and thus, in Plautus, when Palæstro inquires what Sceledrus meant by his living on darnel, he receives for answer, "Quia lusciosus es ;" because you are purblind.

(1013.) By the Chinese laws, for this plant is found both in China and Japan, it is forbidden to be used in fermented liquors. Some of the intoxicating qualities of factitious beer are said to be owing to the admixture of darnel with the malted barley; and a few years ago, two acres of ground in Battersea-fields were

sown with this grain: to what good purpose it could have been applied is unknown, for, although darnel-meal was once recommended as a sedative cataplasm, it has been long disused; and, according to Withering, horses, geese, &c. are killed by darnel, and dogs are peculiarly subject to its influence: mixed in small quantities with their food, it is, however, said to fatten chickens and hogs.

In the "Medical and Physical Journal" there are placed on record several cases of poisoning by darnel, in the human subject. In these, giddiness in the head, pain and swelling of the limbs, succeeded by abscess and gangrene, were the most prominent symptoms. One of the sufferers lost both his legs. Various other cases, exemplifying the poisonous properties of this grain, have been condensed in the chapter on this plant, in the new edition of 'Medical Botany.' This, the only poisonous grass known, is easily distinguished by its two-sided spike and one-valved glumes; the glumes being longer than the bearded locustæ they enclose.

(1014.) SPARTINACEÆ (*Chloridea* of Bartling.) *Spartina*, the rope-grass, gives name to this type, which differs from the foregoing, by the sessile locustæ being crowded into unilateral spikes. The locustæ are either one or many flowered, the upper flower being imperfect. The styles are two, and the glumes keeled.

(1015.) The Spartinæ, with various other tough grasses, are used by the Spaniards for making ropes; and hence the generic name is said to be derived from the Spanish *Esparto*. Compared to the previous type, this includes very few important plants; Eleusine (from *Eleusinia*, an epithet of Ceres,) being almost the only genus that requires especial notice. Thunberg says, *E. coracana* is cultivated as corn in Japan; and Ainslie adds, that crops of it are raised for food upon the Coromandel coast, where it is called *Natchenny*.

(1016.) The types *Hordeaceæ* and *Spartinaceæ*, in both of which the locustæ are sessile, the inflorescence spicate, and the styles two, are thus associated to form the section *Triticinæ*: the first type of the following section is closely connected by its inflorescence with the last in this; but the upward suppression of the flowers and the carinate glumes, will always distinguish the Spartinaceæ.

PANICINÆ.

(1017.) Two types are contained in this section, which, from their respective normal genera, Milium and Saccharum, have been called the *Miliaceæ* and *Saccharaceæ*. They are associated by having the lower florets of the locustæ imperfect, and the glumes keel-less; and are distinguished by the latter having the spikelets articulated with the rachis, and the former non-articulate.

(1018.) MILIACEÆ. In this type the inflorescence, which for

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the most part resembles the last by having the spikelets often crowded in one-sided spikes, a tendency is shewn to the following section by the spikes becoming racemes, and occasionally, although rarely, panicles; the chief differential characters are found in the one or two flowered locustæ, becoming imperfect from below, and in the glumes being distinct, and not keeled.

(1019.) *Panicum:* the genus which denominates this section is thought to have been one of the earliest grasses the seeds of which were used for making bread, and that the names *panicum* and *panis*, have therefore more than a mere etymological affinity. P. miliaceum (the common millet), is still sown in this country, and occasionally used for making puddings, as a substitute for rice; but much more frequently for feeding poultry. P. arborescens is an extraordinary grass; for, although the culm is not thicker than a goosequill, it is said to exceed in height the loftiest trees of Hindoostan, shooting through their branches, and overspreading their summits, as it were with an aerial meadow.

(1020.) SACCHARACEÆ. The inflorescence in this type is rarely spicate, the locustæ being for the most part scattered in panicles; shewing a still closer approach to the Paniculate *Festucinæ*.

In Saccharum, [§ 71, fig. A, B, C,] and its allies, the one or two flowered locustæ are articulated with the rachis, and geminate, the one being sessile, the other pedicled, and, as in the preceding type, the suppression is found in the lowest flowers: the glumes are not keeled.

(1021.) Saccharum (sugar), the *Soukar* of the Arabians, is the most important genus included in this group. It is extraordinary that so fine a grass, possessed of such remarkable properties, should have been unknown to the ancients, or so little sought after by them, when they procured so many luxuries from the East. Galen and Pliny both mention a sweet salt that they call σακχαρ and *Saccharum*, and which was then only used in medicine. This sweet salt is presumed to have been sugar. Until a comparatively modern epoch its chief use was as a febrifuge, a small piece being recommended to be placed on the tongue, to relieve the thirst in fever. Actuarius, who flourished in the tenth century, first substituted 'Indian salt' for honey in pharmaceutical preparations. Like many other medicines it has escaped from the apothecary's store, and, from being dreaded as a drug, is now esteemed a luxury, or rather a necessary of life. In the year 1830, upwards of 193,663

tons of sugar were imported into this country; and in 1829 above 391,519,400 lbs. were retained for home consumption, each person on an average eating about a quarter of a hundred-weight per annum.

The sugar-cane is essentially an equinoctial grass, growing most freely in the hottest climes; it may, however, be cultivated to about the 40th degree of latitude on either side of the equator. Before the discovery of the West Indies, it was grown in the Mediterranean islands; and sugar is still made from the reed in several of the southern provinces of Spain.

(1022.) *Sorghum vulgare*, the Indian millet, is commonly cultivated as corn in Arabia, and most parts of Asia Minor; it has been introduced into the West Indies as a hearty food for the slaves, and is there called negro guinea-corn. In the southern parts of Europe, as in Spain and Italy, it is likewise grown. The flour is white, and is made into loaves or cakes; but it is chiefly used for feeding poultry and cattle. It grows five or six feet high, is a handsome plant, and its long awns protect the grains from the rapacity of birds.

Andropogon is another genus in this type; one species of which (*A. schœnanthus*) has an aromatic bitter flavour, and fragrant smell. The Indian practitioners esteem an infusion of the roasted leaves an excellent stomachic; and in the Moluccas a fragrant essential oil is procured from the culms and leaves.

Anthoxanthum odoratum, the sweet-smelling vernal grass, has likewise a very fragrant odour. Its glumes are covered with small dots, which are probably secreting organs. The odour of this plant is owing to the benzoic acid it forms; and it is remarkable for being scentless, while growing, but giving out, when cut, the very pleasant smell which is characteristic of new-mown hay. It has been proposed to enrich pasture-lands, and to improve the flavour of mutton, by sowing this grass where it is not common. On some downs it is abundant; but, as it flowers early, a difficulty occurs in the collection of its seeds. The benzoic acid found in the excretions of graminivorous animals is believed to depend on their consumption of this plant.

(1023.) The types *Miliaceæ* and *Saccharaceæ* are, by their mixed inflorescence, intermediate between the spicate *Triticinæ* and the paniculate *Festucinæ*. They are associated to form the section *Panicinæ*, by the important character of the suppression in

their flowers taking place in the lower or outer florets; their glumes are likewise keel-less; by which characters the spicate genera may be distinguished from the *Hordeaceæ* and *Spartinaceæ*, and the paniculate ones from the following types.

FESTUCINÆ.

(1024.) As some of the Panicinæ anticipated the paniculate inflorescence of the Festucinæ, so some of the Festucinæ, by the congestion of their panicles, repeat the spiciform inflorescence of the Miliaceæ and Triticinæ; and this is the most evident in the border type, in which however the locustæ, on examination, will be found to be truly panicled; the ambiguous appearance depending on the shortening of the flower-stalks.

(1025.) PHALARIDACEÆ. In Phalaris, and its allies, the paniculate locustæ are crowded into the form of a spike; the spikelets are one or two flowered, the upper being imperfect; the glumes are distinct and keeled; the stamina three.

(1026.) *Phleum*, the cat's-tail, *Alopecurus*, the fox-tail, and several other pasture-grasses, not of the richest kind, (§ 1011,) are found in this type. They are chiefly valuable as growing on poor soils; and the Alopecurus, for the bulk and weight of hay that it produces, which is greater than is afforded by any other grass.

The *Phalaris canariensis* is cultivated in this country for the sake of its seeds, which form the common food of canaries and other singing birds. The chaff is relished by horses, but the culms are short, and it produces but little fodder. It is chiefly grown in the Isle of Thanet. Crops may also be yearly seen near Canterbury, and in other parts of Kent.

(1027.) AVENACEÆ. *Avena*, *Briza*, *Glyceria*, *Poa*, *Bromus*, *Festuca*, *Dactylis*, *Arundo*, and numerous other genera, in which the "locustæ are paniculate, and two or many flowered, the imperfection being in the upper florets," are associated to form this type, which is the largest in the section. With the exception of the oat, it chiefly consists of pascual genera.

(1028.) Oat is a Saxon word (ate), and seems to be connected with the verb, *to eat*. The oat is the grain of cold countries, where it is considered bread-corn, and used as food for men. In the more temperate regions it is chiefly cultivated as horse-corn; but in warm latitudes the ears become so small, and the grain so poor, that it always affords an unprofitable crop. Oatmeal cakes and

porridge are still common as food in our northern provinces; and oatmeal gruel, as well as the various preparations of the grain, in the several forms of common, split, Embden, and patent groats, are familiar articles in the sick man's bill of fare. The last named is the purest oat-flour, and one of the lightest and pleasantest kinds of simple farinaceous food.

(1029.) The animal oat, which is often regarded with wonder, is the awn of the *Avena sterilis:* it is so delicate an hygrometer, and so exceedingly sensible to changes in the moisture of the atmosphere, that it is kept by ordinary vicissitudes in constant (apparently spontaneous) motion, and thus resembles some strange insect crawling about.

(1030.) *Glyceria aquatica*, the water sweet-grass, and the various species of *Poa*, are valuable as fodder. The former grows freely in wet marshy situations, such as the fens of Lincoln and Cambridge shires, where it is sometimes cut three times a year. Its growth is so rapid, that it fills up ditches and water-courses, and thus often becomes a formidable antagonist to draining fens. The lodes in the Isle of Ely are said by Curtis to become thus encroached on, and they are obliged to be cleansed by dragging a machine called a bear up and down the streams, which cuts the plants up by their roots.

(1031.) The *Bromi* are not very valuable pasture grasses, being chiefly coarse-leaved annuals. Loudon states that "the seeds of *Bromus secalinus*, which are often found in wheat and rye crops, are believed to impart a bitter taste to the bread, and to have similar narcotic qualities to the Lolium temulentum. In Scania, the panicles are used to dye green. The seeds of *B. mollis* are also said to bring on giddiness in men and quadrupeds, and to be fatal to poultry." *Rye* was formerly supposed to degenerate into *Brome-grass;* hence B. secalinus, and multiflorus, are still called *smooth rye*, and *downy rye:* hence also the former received its specific name.

(1032.) *Arundo*, the reed, shews a tendency, in some of its species, to become arborescent. *A. donax*, which is common in the south of Europe, is used in Italy, Spain, and Portugal, as fence-wood, vine-poles, fishing-rods, &c. From the two latter countries large quantities of these reeds are exported, to supply the wants of the anglers and weavers of Britain. *A. Phragmites*, which grows profusely on the banks of the Thames, is encouraged to

cover embankments, as the running roots confirm the river walls, and prevent the wasting action of the water. The culms of this reed make the best thatch known; they are likewise much used to form the substratum in plaster floors.

(1033.) The *Festucæ*, or fescue grasses, are many of them valuable for pasture. *Festuca ovina*, the sheep's fescue-grass, is met with in great quantities on the downs; and, its fine foliage being well fitted for the mouths of sheep, it is supposed to contribute to the superiority of the Southdown mutton. This is one of the best grasses for bowling-greens and lawns; it is soft, fine, and does not require frequent mowing; it likewise roots deeply, and therefore keeps green in dry weather.

(1034.) Agrostidaceæ. In Agrostis, and its allies, which form this type, the paniculate locustæ are one or two flowered, the upper florets being imperfect; and the glumes and glumelles submembranaceous.

(1035.) The *Agrostides*, as their name implies, are field or meadow grasses: the most valuable species is the *A. stolonifera*, or fiorin, which is remarkable for its fertility. It was one of the species noticed by Dr. Maton among the Orcheston long grass, specimens of it, and of Poa trivialis, being found seven feet and ten feet long. Two acres and a half of land in this district (near Salisbury) yielded, according to the account published in the Linnæan Transactions, the astonishing quantity of ten tons of hay in one year. A. stolonifera is one of the couch-grasses of the farmer. The creeping underground stems are replete with nourishment, and, in Italy and the South of France, they are collected by the poor people, and sold as food for horses. They contain much saccharine matter; and it has been proposed to ferment them, and brew table-beer.

(1036.) Stipaceæ. Stipa, the feather-grass, and a few other not very important genera, are found in this type: they are associated by having "their paniculate locustæ one or two flowered, the upper imperfect; the glumes are membranaceous, the inferior glumelle coriaceous, convolute, and awned; styles two.

(1037.) *Stipa pennata* is an exceedingly beautiful grass, small tufts of which bear a great resemblance to the tail and wings of a bird of paradise. Gerarde says, that in his time this grass was worn as an ornament by "sundry ladies, instead of feathers." *S. tenacissima* is one of the rope-grasses of the Spaniards.

(1038.) ORYZACEÆ. The Rice, and its allies, which, collectively, form this type, are associated by having their "locustæ panicled and one-flowered; the glumes distinct, keeled, and the lower glumelle compressed and keeled; the stamina, for the most part, are more than three."

(1039.) The *Rice* (*Oryza*,) if estimated by the proportion of food it contributes to the sustenance of man, is the most valuable of all the grasses, and perhaps the most useful vegetable grown; as the unnumbered millions of the East are supported almost wholly on this corn, for the growth of which the extensive swamps of those hot countries, and their unrivalled means of irrigation, are peculiarly adapted. Rice is the staple corn of the tropics, as the oat is of the northern, and wheat of the temperate regions. The culture of rice is an exceedingly unhealthy occupation; for the frequent flooding of the fields keeps them constantly in a swampy state, and favours the production of malaria. Rice has been raised in England on the banks of the Thames, a crop having been gathered in near Windsor. In Italy it is cultivated with success; but artificial irrigation has been carried there to a higher degree of perfection than in any other part of Europe. Still it shrinks into insignificance if compared to the gigantic labours of the east, as will be seen from the following account.

"Between the fort of Nundydroog and the rising ground on which we stopped to view the prospect, there extended a valley some six or eight miles across, the whole bottom of which was marked with a succession of artificial tanks, used for irrigating myriads of rice fields lying below the level of these ponds.

"A young officer accompanied me the next day to the rock; and, what interested me fully as much as the traces of Lord Cornwallis's siege and successful storming of the fort of Nundydroog, in 1792, was the view from the top of the rock, and particularly the sight of a vast number of those extraordinary tanks or artificial ponds, for irrigating the rice fields, for which that part of the peninsula is so remarkable.

"The table-land of Mysore, which stands several thousand feet above the level of the sea, is not strictly a flat plain, as the name would imply; neither is it mountainous nor even very hilly; and yet the surface is extremely uneven, being moulded into gently sloping ridges, which form between them a succession of long valleys slightly inclined, broad and shallow, and winding about in all directions. Across almost every one of these valleys the natives have thrown embankments, some of them of very ancient date, though some are even so recent as the dynasty of Hyder. These walls or *bunds*, as they are called, are made of considerable strength, and when of small extent they generally curve upwards, so as to offer the convex side to the pressure of the water; but if they be a mile or several miles in length, the embankments assume a wavering snake-like shape; with what particular view I know not, but I suppose from some idea of strength.

One valley was pointed out to me, which might be about a mile broad and forty miles long from end to end: this included between thirty and forty tanks, some large, and some small, every square yard of the intermediate space between the bunds being richly cultivated, while the surrounding country appeared to be condemned to nearly perennial sterility. I believe that almost the whole rice crop of Mysore is derived from irrigation.

"This vast supply of water is gained partly by the method of tanks just described, and partly by tapping the Cauvery and other rivers, by means of subaqueous dams built during the dry season diagonally across the bed of the stream. The effect of these dams is to direct a portion of the river into lateral trenches, stretching far and wide over the country. From these it is again drawn off to water the rice fields. I remember hearing a traveller describe the mode in which the great river Indus is tapped or drawn off in this manner to the right and left for the purpose of agriculture, till the unhappy stream is fairly exhausted and its channel left dry. One is so much accustomed to consider the mighty mass of waters, forming a river of any magnitude, as something beyond the power of man to control, that it requires good evidence to satisfy our incredulity on this point. But if the Indus, in the districts alluded to, resemble the Mississippi and many other streams flowing over extensive alluvial countries, there need be no difficulty in conceding such a transfer of the whole of its waters from the ordinary bed of the stream to the fields on either side; because rivers which traverse deltas almost invariably flow along the summits of ridges somewhat higher than the adjacent country. These ridges, it is true, are so wide and flat that their elevation at most places can scarcely be detected by the eye; but still the inclination of their sides is abundantly sufficient to admit of water draining away from, instead of flowing towards, the river.

"During the fierce struggles between the French and English in the south of India, the embankments of the Cauvery were frequently cut, and the whole country, in consequence, laid under water. To explain this, it must be mentioned that as rivers which run along deltas, or along ground nearly level, are liable to overflow their banks during the rainy season, it becomes necessary, in order to prevent the country being inundated, to raise walls or embankments to confine the streams. These, (which are called in Louisiana levées, in India bunds,) being raised a little higher than the surface of the river at its highest, confine the stream within proper limits. But, as the floods of each successive year bring down a prodigious mass of gravel and sand, the wear and tear of the mountains, fields, and forests, through which the tributary streams have passed, a certain portion of the largest and heaviest of these materials must subside, and remain at the bottom when the river reaches the low grounds, where its rate of motion is much diminished. This addition, though it be small in any one year, gradually raises the bed of the river. If this rise were not carefully met by a correspondent annual elevation of the artificial embankment, it is obvious that the water in the course of time would periodically flow over and submerge the country. The consequence of these alternate struggles between the waters trying to escape and man insisting upon confining them, has been to lift the whole body of the Cauvery in its passage across the Carnatic several feet above the highest level of the surrounding country. The power of deluging the surrounding country was therefore a very obvious, though a dreadful weapon, in the hands of whichever

party held possession of the banks during those formidable wars in which the French and English contended for the sovereignty of Hindoostan. In the long period of peaceful and secure repose which those regions have enjoyed since the contest has been terminated by the unquestioned supremacy of one party, the supply of water so curiously raised into the air has been appropriated exclusively to the irrigation of the country.

"In the upper lands of Mysore the peasants'are dependent chiefly on their tanks for moisture, as the rains are uncertain in quantity, and transient in their effects. The stock of water collected in these numberless and extensive tanks or ponds, many of which well deserve the name of lakes, is capable of being distributed in the precise quantity and at the precise times required. I have been often amused at observing with what scrupulous care the persons appointed to distribute the water let it off from these magnificent reservoirs. The thirsty soil of the Mysore, parched and riven by heat, drinks up the fluid with a kind of relish, —a sort of animated enjoyment, at which I was never tired of looking.

"In describing things which lie so much out of the ordinary course of observation, one becomes sensible of the poverty of language. Thus, the word *tank* suggests to most people the idea of a common cistern attached to a dwelling-house and filled with rain-water from pipes along the roof. The word *pond*, again, recalls images of muddy water, draggled post-horses, rank weeds, and a combined fleet of ducks and geese engaged in common warfare against frogs and worms. To call the tanks of Mysore by the name of lakes would be nearer the mark, for many of them well deserve that appellation. The *Moota Talou*, for example, or *Rich Tank*, near Seringapatam, I understand, is nearly thirty miles in circumference. I never saw that particular sheet of water, but many of the artificial lakes which I did examine measured six, eight, and ten miles round; and so vast are their numbers, that I remember counting considerably more than 100 at one view from the top of Nundydroog; nor do I believe that the least of these could have been less than two or three miles in circuit.

"Dr. Buchanan, in his journey through those countries, made by order of Lord Wellesley, in 1800, shortly after the capture of Seringapatam, describes minutely the formation of these tanks, or *Erays*, as they are called in the Tamul language. The *Saymbrumbacum Tank*, not far from Madras, he says, is eight miles in length by three in width, and its contents are sufficient to supply with water the lands of thirty-two villages for eighteen months, supposing the usual rains to fail."—*Hall's Fragments of Voyages*, pp. 88—108, vol. iii. 3d series.

(1040.) Rice is imported into England in large quantities, both from the East Indies and America. The Carolina rice is said to be the produce of one small bag, given as a present, by Dubois, the treasurer of the East India Company, to a Carolina trader; and in 1698 sixty tons were sent home. Upwards of one hundred thousand bags of rice are now annually imported, and the quantity is gradually increasing.

(1041.) The Canada rice, *Zizania fluitans*, although not yet much cultivated, has all the natural capabilities to become a valuable corn. Its grains are large, and replete with a fine bland

farina. It grows abundantly in the shallow waters of North America, and has been acclimated here; it grows freely both in Middlesex and Rosshire. Attempts are being made, which it is to be hoped will be successful, to cultivate it in Ireland. Pinkerton says, "this plant seems to be designed by nature to become the breadcorn of the North."

(1042.) BAMBUSACEÆ. The Bamboo, and other arborescent grasses, are distinguished from the associated types not only by their port, but also by "their paniculate locustæ being many-flowered, their stamina six, and style single."

(1043.) *Bambusa*, the name of the normal genus, has been formed from the Indian *Bambos*. The tree-like size of these plants associates them in some measure with palms. They are applied, in China, India, and Japan, to a great number of useful purposes: sections of the small ones are made into cups, and of the larger ones into tubs and boxes; water-pipes are often made of them; and they are used in the construction of fences, building houses and boats, and making various articles of furniture. The tender tops of the young shoots form a favourite West India pickle.

Perhaps the best idea, though still a faint one, of the beauty and magnificence of these arborescent grasses, may be given to the untravelled naturalist, by quoting Capt. Basil Hall's account of the impression a first view produced on him. He says,

"Early in the morning, of a beautiful day in the latter end of September, I set out from the bare table-land of Mysore, and proceeded towards the hilly and thickly-wooded regions overhanging the Malabar country. When I awoke in my palankeen, I knew not very distinctly where I had got to, for I had been dreaming all night about the monstrous statue at Shrivaabalagol. I sat up, drew the door gently back, and, looking out, found myself in the midst of one of the most curious and magnificent scenes which my eyes had ever beheld. It appeared as if I were travelling among the clustered columns of some enormous and enchanted Gothic cathedral, compared to which the minster at York, or the cathedral at Winchester, would have seemed mere baby-houses; the ground extended on all sides as smooth and flat, and clear of underwood, as if the whole had been paved with grave-stones. From this level surface rose on every hand, and as far as the eye could penetrate into the forest, immense symmetrical clusters of bamboo, varying in diameter at their base from six feet to twenty or thirty; and even to twice that width, as I ascertained by actual measurement. For about eight or ten feet from the ground, each of these clusters or columns preserved a form nearly cylindrical, after which they began gradually to swell outwards, each bamboo assuming for itself a graceful curve, and rising to the height, some of sixty, some of eighty, and some even of one hundred feet in the air, the extreme end being at times horizontal, or even drooping gently over, like the tips of the feathers in the Prince of Wales's plume. These gorgeous clusters stood at the

distance of fifteen or twenty yards from one another, and, being totally free from the interruption of brushwood, could be distinguished at a great distance—more than a mile certainly, in every direction, forming, under the influence of an active imagination, naves and transepts, aisles and choirs, such as none but a Gothic architect ever dared to conceive. Overhead the interlacing curves of the bamboos constituted as complete a groined roof as that of Winchester or Westminster, on a scale of grandeur far beyond the bold conception even of those wonderful artists who devised that glorious school of architecture, which, in the opinion of many people, has raised the dark centuries immediately subsequent to the era of the crusades, almost to the level of the days of Pericles.

"On counting the separate bamboos in some of the smallest, and also in some of the largest clusters, I found the numbers to vary from twenty to thirty to upwards of two hundred, and the height generally from sixty to a hundred feet from the ground, to the point of intersection of the curves overhead. Most of the bamboos were somewhat thicker than a man's thigh at the ground, where, as I have before said, they are clustered so close as to be almost in contact. They then taper off very gradually to the extreme end, where the point is not thicker than a quill.

"There occurs a joint at about every foot and a half, distinguished not only by a slight flat ring or fillet, but by a set of small branches, eight or ten feet long, striking out at right angles to the main bamboo. These minor shoots are again divided into joints, from which other series of shoots, still more minute, are thrown out; and so on for many successions, the last always terminating in a sharp pointed-narrow leaf, two or three inches long and half an inch wide in the middle, not unlike a large tea leaf when spread out. As each bamboo, of the hundred or more forming the cluster, sends out shoots from every joint, and as all the joints of these subordinate plants do the same, a compact mass is formed by these innumerable little branches, which cross one another at every possible angle. If a person were to fill a hat full of pins and needles, and shake it about for some minutes, it might give a notion of the inextricable confusion which is presented to the eye on looking into one of these clustered columns of bamboos. It is only at the top, where the bend takes place, that the foliage has full room to play, or where the tapering arms of this magnificent plant form, by their meetings and crossings, a complete system of pointed arches.

"What surprised me very much, and greatly puzzled me at first, was, to observe that, notwithstanding the multitude of lateral shoots from each of the main bamboos, and from all the subordinate branches, not a single trace of displacement, or the slightest obstruction to the growth of any branch, could be detected. Every person must have heard of the astonishing rapidity of the growth of the bamboo; it is said indeed that in one season it starts up to its whole length. I do not know if this be true, but am quite certain that if one of the main bamboos were to spring from the ground in the centre, or even near the sides of the cluster, and that from its joints there were at the same time to sprout out the lateral branches I have described, it would be impossible for the main stem to force its way through the obstructions presented by the network, formed by the little branches growing from the joints of the other bamboos in the cluster.

"After examining a considerable number of the clusters, however, we can, I think, perceive how nature manages this difficult affair. When the bamboo first

springs out of the ground it is about as thick as a man's wrist, but it is armed with a very sharp point, not unlike that of a wooden instrument called a fid, which sailors make use of in splicing ropes; as this point is extremely hard, and the bamboo always highly polished, it readily makes its way through the very thickest masses of the little branches, as one might thrust a sword through a quickset hedge. Thus the bamboo, whose growth is prodigiously rapid, starts upwards, and by reason of its smooth sharp end, and perfectly smooth sides, easily makes its way to its extreme length and thickness, without, as I conceive, sending out a single lateral shoot from any of its joints, till the utmost extent has been gained. The subordinate branches from the joints then, but not till then, begin to start out horizontally, all these being, after the manner of the principal stem, exempted from lateral shoots at their joints till their utmost length has been reached. In consequence of this beautiful arrangement, none of these successive branches, however numerous or delicate, find any difficulty in piercing the confusion.

"I saw bamboos in every different stage of this process, and in particular I noticed several of the main stems rising to the height of seventy feet and upwards, of a clear yellow colour, and evidently of recent growth, but without a single lateral branch growing from their joints from top to bottom; and this led me to infer that their extreme height had not yet been reached, or was but just attained."

(1044.) The *Bambusaceæ*, *Oryzaceæ*, *Stipaceæ*, *Agrostidaceæ*, *Avenaceæ*, and *Phalaridaceæ*, are associated to form the section Festucinæ. They are arborescent or herbaceous grasses, with paniculate inflorescence; and the imperfect florets for the most part the upper ones of each locusta. This last-named character will at once distinguish the four types last mentioned from any of the *Panicinæ;* and they are the only ones likely to be confounded.

(1045.) *Zea*, *Coix*, *Lygeum*, and several other genera, the affinities of which are doubtful, are placed by Bartling in an appendix to the order. Further examination will probably attach some of these to the foregoing types; and Zea, Coix, &c. seem to afford materials for constructing another group.

(1046.) *Zea Mays* is the well-known Indian corn, which, although indigenous to warmer countries than our own, will thrive in favourable situations here. The crops, however, are uncertain, and the bread made from Mays flour is so inferior to wheaten, that little temptation exists to continue its culture here. In the Old world it is comparatively little grown, but in the Western hemisphere it rises into great agricultural importance.

Maize, like other corn, is capable of affording an inebriating liquor; and, as an example of the desire that prevails among all people, as well savage as civilized, to possess the power of intoxicating themselves, it may be mentioned, that with some Indian tribes, after the gathering in of their harvest, for the want of other mills and means, it is customary to give each of the old squaws a quantity of grain to chew, and a calabash to receive the triturated corn when reduced to the

form of paste. The contents of the calabashes are subsequently mixed, and water being added, the whole is left to ferment, and a sort of beer or wine is thus produced, of which they are very fond, and which they are prone to drink to excess.

The *Zea Curagua*, or cross-corn, is regarded with a kind of superstitious veneration in Valparaiso, from the grains, when roasted, splitting regularly into the form of a cross.

(1047.) The three sections, *Festucinæ*, *Panicinæ*, and *Triticinæ*, are associated to form the order GRAMINALES, or POALES, the characters of which have been already given, [§ 997;] and the two orders, GRAMINALES, and CYPERALES, are the only ones included in the class GRAMINA, or Grassedges, the Glumaceæ of some, the Culmiferæ of other writers. The grasses differentially considered are *glumose flowering plants, with endogenous stems and monocotyledonous or one-lobed seeds.*

(1048.) Collectively described, they are tubivascular herbaceous plants, rarely shrubby or arborescent; roots either annual or perennial; rhizomata endogenous; culms for the most part simple, though sometimes branched, and either round or angular, jointed or knotless, solid or hollow. The leaves are simple, alternate, entire with linear veins; leaf-stalks vaginate; inflorescence spicate, racemose or paniculate; flowers arranged in locustæ or spikelets, the valves of the perianth often imperfect or absent; stamens, for the most part three, or some multiple of three; filaments free; anthers two-celled; germen free; styles two or three, often connate; fruit a caryopsis or achenium; seed erect; albumen farinaceous, and of the shape of the fruit; embryo at the base of the seed, either within or without the perisperm, and imparilobed: the cotyledon being single, or when two are developed, they are alternate, not opposite to each other.

(1049.) *Tabular Conspectus of the Gramina, or Grassedges.*

Class.	Orders.	Sections.	Types.
GRAMINA. (1047 and 1048)	GRAMINALES or POALES. (998)	Festucinæ (1044)	*Bambusaceæ* (1042)
			Oryzaceæ (1038)
			Stipaceæ (1036)
			Agrostidaceæ (1034)
			Avenaceæ (1027)
			Phalaridaceæ (1025)
		Panicinæ (1023)	*Saccharaceæ* (1020)
			Miliaceæ (1018)
		Triticinæ (1016)	*Spartinaceæ* (1014)
			Hordeaceæ (1006)
	CYPERALES or (984) CALAMARIÆ.	Caricinæ (994)	*Caricaceæ* (995)
		Cyperinæ	*Scirpaceæ* (991)
			Papyraceæ. (993)

(1050.) To the grasses thus defined it has been occasionally proposed to add various small groups of grass-like plants, such as the reed-mace and the bur-reed (*Typhaceæ*), the true rushes (*Juncaceæ*), and the cord-rushes or rope-grasses (*Restiaceæ*, § 1100, et seq.): but although their affinity to the grasses and sedges is obvious, their relationship to the *Liliales* of the following class, *Palmares*, seems to be nearer and more decided. Thus, without the bur-reeds (*Spargania*), which are herbaceous allies of the screw-pine (*Pandanus*), can be excluded from the *Typhaceæ;* the subglumaceous rushes shewn to have less similitude to lilies than to grasses; and the *Xyridaceæ* proved not to be intimately allied to the *Restiaceæ* and *Ephemeraceæ*, as well as more remotely to *Orchidaceæ;* neither of them can, consistently with a due regard to their natural affinities, be severed from the Palmares and attached to the Gramina; and this, the more especially as their floral envelopes when present are not *glumes*, but *perianths*, [vide § 1076], and although often husk-like are frequently subpetaloid, and sometimes even decidedly corollate.

(1051.) Whether these osculant groups are located among the *Palmares*, or subjoined to the Gramina, is not, however, a point of very great importance. They are confessedly transitional from the one class to the other, and should the glumaceous texture of the flower coverings be esteemed an associating character of more importance than the alternate disposition of the valves in glumes, and their whorled arrangement in perianths, the above-named groups, or some of them, may form an additional order of the present class called the JUNCALES, or TYPHALES.

(1052.) Allusion has several times been made to the vast importance of the grasses as a source of food, both direct and indirect, to brute animals and man. But perhaps a bare statistical account of the quantity of corn consumed in one nation, in a given time, may afford a better idea of the importance of the cereal grasses to man, than any more lengthened commendation; and perhaps our own country, although here less vegetable food is eaten than in many other nations, (the French averaging each person ten bushels a year to our one quarter,) may still afford the best practical examples.

From a laborious series of investigations, Mr. M'Culloch has computed that the average daily consumption of corn in the United Kingdom amounts to 154,762 quarters; *i. e.* 1,238,096 bushels are either devoured or otherwise used by man, to minister directly or indirectly to his necessities every day in this comparatively minute spot of earth. One week's consumption, the same eminent authority informs us, is 1,083,333 quarters, or 4,333,232 combs, or 8,666,664 bushels; and the yearly consumption 52,000,000 quarters, or 416,000,000

bushels; and to this should be added 100,000 bags of rice, besides 200,000 tons, or nearly 450 million pounds of sugar.

(1053.) But in order, however, fairly to estimate the value of the grasses to man, a report should also be attempted of the quantity consumed as pasturage, a great proportion of which becomes indirectly human food, when converted into milk, butter, cheese, mutton, beef, and veal, and still more is rendered subservient to our comfort as the support of the beasts of burden that labour for the benefit of man. On several of these points, however, the means of calculation are too imperfect to allow any general statement to be adventured, still on one, viz. the grass that men indirectly eat, the same political economist will enable us to form some notion; for we learn that the average yearly consumption of butcher's meat, by every individual, young and old, amounts to nearly one hundred weight: it has indeed been estimated at more than double this, exclusive of fish and poultry; and statistical accounts declare that, not computing pork, bacon, or poultry, the population of London alone annually consumes 154,434,850 pounds of meat.

(1054.) It has been estimated that a horse requires for its support as much land as would on an average raise sufficient food for eight men; now there are in Great Britain upwards of a million of horses engaged in various ways, in the transport of passengers and goods, all of which are supported chiefly, if not entirely, upon the grasses. But again: the stock of cattle in England averages nearly 3,000,000, that in Scotland upwards of 1,000,000; together, in round numbers, 5,000,000. In France it is stated to be 6,681,000, in Prussia 4,355,000, in the German Confederation 12,000,000. The stock of sheep in England, four years ago, was estimated at 25,000,000, and in Scotland 5,000,000, being 30,000,000 in Great Britain alone, exclusive of Ireland; and of these, it is said, that 33,000 sheep and lambs are slaughtered weekly in Smithfield only, *i.e.* from 1,250,000 to 1,500,000 per annum. Add to the foregoing the immensity of cheese produced; Cheshire, it is calculated, affords about 11,500 tons a year, Warwickshire sends annually about 20,000 tons to London, besides a large quantity to Birmingham and other places; and, although an estimate cannot be made of the entire quantity produced or consumed either in the metropolis or in the country, Dr. Colquhoun states, that the value of butter and cheese consumed in the United Kingdom must be worth at least 5,000,000*l.* a year, exclusive of the milk from which they are made.

This sum, as M'Culloch says, is perhaps too high, but there are not data sufficient at command either to correct or verify it; and from supplies produced in single counties, we are assured it must be very great: for it is known that fifty million pounds of butter are annually brought into this great city; which, at the average production of 168lbs. per annum, will require 280,000 cows to be kept for the supply of the London market only; exclusive of those that must afford the same article of food to the other parts of the kingdom, and exclusive of those which must be kept to yield the ordinary supply of milk, of which a very faint notion can be given, for so much less milk is drank in London than in the country, and by fraud the London milk is so much increased in measure, that the 9000 and upwards of milch cows which are kept in the environs, are not a fair proportion of what are kept for the supply of milk in other places. Now each cow on an average yields nine quarts of milk a day; hence 81,000 quarts of pure milk are consumed in the metropolis daily, *i.e.* thirty million quarts per annum. As the grasses are known to be the chief support of the animals whence such enormous supplies of human food are drawn, they are indirectly, no less than directly, the

staple sustenance of man; and when traced to their source, the various articles above named, of which a sample rather than a catalogue has been given, can scarcely be esteemed other than grasses in disguise.

GEOGRAPHICAL DISTRIBUTION OF THE GRAMINA.

(1055.) As affording their chief food both to men and animals, no plants are more important than the grasses, and hence there are no plants that are more universally distributed over the surface of the globe, or that have been more varied, to adapt them to the varied circumstances of the countries in which they grow. Certain plants are confined to certain places, and others of still greater range are restrained within certain latitudes, but grasses extend from the equator almost to the poles. In the frigid zone, barley, oats, and lyme-grass flourish, and are cultivated as bread-corn in Lapland as far north as the seventieth degree; and even Spitzbergen is not destitute of grass. In more temperate regions rye is added to the list of cultivated corn; but in England, France, and Germany, wheat becomes the staple food of man, while barley, oats, and rye are chiefly cultivated as provender for horses, for brewing, or for the use of the distillery. In Spain, Portugal, Italy, and Greece, maize is added to the more northern corns, and in hot swampy districts rice; where rye and oats are seldom seen, and in some parts unknown, and where barley becomes the food of the beasts of burden.

(1056.) In many places other flowering Monocotyledons, such as the palms and the bananas, with a few Dicotyledons, as the batatas, the manihot, and the bread-fruit, in a great measure supply the place of cereal grasses, or entirely supersede the use of corn. But these are exceptions to the general rule; and hence the grasses are of more importance both in a commercial and political point of view, as well as in the general economy of nature, than any other vegetables known. In most countries they form the principal part of the external covering of the earth; and, in respect to ornament, they play a very prominent part, giving to the plains and hills their lovely green, and bordering the blue waters of the lake and the meandering course of the rivulet, or the majestic windings of the mighty stream. They also restrain the degradation of upland and hilly grounds, fix loose sands, and prevent deluges more fatal than watery floods. They materially affect the atmosphere, especially its quantity of moisture. They support a whole world of insects, and afford the chief nourishment of domestic animals. They are on this account of the utmost consideration in the breeding of cattle; and, since the most important of the cultivated plants belong to them, they constitute likewise the basis of agriculture, one of the breasts of the state. But the rearing of cattle and of corn is not only the main support of nations; it determines the degree of culture and mode of life, and, to a certain extent also, the manners and customs of particular people. The geographical relations of the Gramina must therefore be interesting, not merely to the botanist, but to those who occupy themselves with the sciences relating to man, and the policy of nations.

(1057.) The pasture grasses and the sedges are less numerous in tropical than in extra-tropical regions; they grow to a larger size, becoming arborescent, and less fit for food. They also, from their magnitude, are more distant from each other, and do not form the compact continuous turf which characterizes the verdant fields of temperate latitudes. A final cause for these variations may be found in the acknowledged tendency that such a disposition has to promote the health of man, for in hot climates, where much animal food would be injurious, the pas-

cual grasses on which flocks and herds are fed, are less abundant than in the temperate latitudes, where flesh in larger quantities is required for human food.

(1058.) Of the two orders into which the grasses have been divided, the Graminales extend further towards the equator than the Cyperales, which are in the greatest relative proportion in northern latitudes. Thus, in Lapland, notwithstanding the very different extent of the two orders, the sedges are equal in number to the true grasses; but if traced thence to the line, the relative proportion is very much reduced. The several types which prevail are also changed. Northwards the *Caricinæ* and *Scirpaceæ* are predominant, while towards the equator the paper-reed and other *Papyraceæ*, are chiefly found, which here are either rare or totally unknown.

(1059.) Thus, from the calculations of Humboldt, and others, it appears that *Cyperales* form but $\frac{1}{57}$ of the flowering plants in tropical America, $\frac{1}{25}$ in India; and $\frac{1}{18}$ in Western Africa, and $\frac{1}{14}$ in New Holland. On an average they amount to about $\frac{1}{20}$ in the temperate regions; being in Sicily $\frac{1}{57}$, France $\frac{1}{27}$, Germany $\frac{1}{18}$, Denmark $\frac{1}{16}$, and Sweden about $\frac{1}{12}$: in the frigid zone, *i. e.* in Lapland and Kamtschatka, their proportion is about $\frac{1}{2}$, in Melville Island $\frac{1}{17}$.

(1060.) From similar calculations, the general distribution of the grasses would seem to vary in about the following proportions. Within the tropics rather more than $\frac{1}{15}$, in the temperate regions $\frac{1}{13}$, in the frigid zone $\frac{1}{10}$: in Melville Island almost $\frac{1}{5}$.

Again: of the nearly 2000 known species about 800 are tropical, and from 1150 to 1200 are extra-tropical.

(1061.) Of the various subordinate types and sections not one is confined exclusively to either zone, although some genera and many species are local. But the relatively greater proportion of the *Bambusaceæ*, *Saccharaceæ*, *Miliaceæ*, and *Spartinaceæ*, within the tropics, justifies their enumeration as tropical groups, while the *Agrostidaceæ*, *Avenaceæ*, and *Hordeaceæ*, for the contrary reason, may be esteemed extra-tropical. The *Oryzaceæ* and *Stipaceæ*, are pretty equally divided, the former being rather a tropical, and the latter an extra-tropical type.

(1062.) The distribution as to altitude, is nearly consonant with that as to latitude, the *Miliaceæ* and *Saccharaceæ* predominating on the lower, the *Avenaceæ* and *Agrostidaceæ* on the higher elevations. Thus, above 9,600 feet, the *Avenaceæ* are to the *Miliaceæ* as 8 : 1; but below 1200 feet, only as 7 : 39. Some local exceptions, however, are known to this general law. In Southern Europe, for example, the grasses, seem to diminish instead of to increase, according to the elevation, for in the Alpine Flora their relative proportion is only $\frac{1}{18}$, while it is $\frac{1}{12}$, or $\frac{1}{14}$ on the plains.

(1063.) A considerable difference has been shewn to prevail in the distribution of the types, but " between the genera the contrast is naturally greater, and manifests itself not only according to the latitude, but also the longitude. Thus, in the torrid zone, the genus Paspalus has a decided preponderance in the New World. Most of the genera, however, especially the larger, for example, Panicum, Andropogon, and Chloris, are everywhere nearly equal, those that are peculiar being generally not at all numerous. The generic difference between North America and the temperate regions of the European continent is very small. In North America, however, a greater number of tropical forms appears. Between the two temperate zones also the distinction seems to be by no means considerable. Of thirty-six genera from the Cape, thirty occur in the temperate zone of the northern hemisphere, while in other families, Southern Africa has many peculiar

to itself. In the extra-tropical part of New Holland, the greater number of genera is found also in the north (about two-thirds); and this appears to be still more the case in the southern parts of South America, as well as New Zealand. One of the most extensively distributed genera is Poa. It is found almost over the whole earth; and, although it reaches its maximum in the temperate, has also many species in the torrid zone. A tendency to a wider distribution in the family of the grasses, is found, not only in the groups and genera, but also in the species. Among many examples, we particularize only *Lappago racemosa*, which occurs in the south of Europe, in Arabia, in both Indies, and in South America; *Cenchrus echinatus*, *Festuca myurus*, *Poa megastachya*, *Andropogon allionii*, *Holcus halepensis*, in the highlands of South America, and in Europe; *Panicum crus-galli*, *P. glaucum*, *Cynodon dactylon*, *Holcus gryllus*, *Arundo Phragmites*, and *Festuca fluitans*, in Europe and New Holland; *Paspalus vaginatus*, in Tranquebar, Jamaica, and the Isle of France; *P. filiformis*, in India, Jamaica, and North America; *Rottbollia dimidiala*, in Guinea, at the Cape, and in Jamaica; and *Imperata arundinacea*, on the Mediterranean, in India, and New Holland.

What has been said of the decided influence of the degrees of latitude on groups and genera, holds also of the habitus of vegetation in general. The greatest differences between tropical and extra-tropical grasses appear to be the following.

"1. The tropical grasses acquire a much greater height, and occasionally assume the appearance of trees. Some species of Bambusa are from fifty to sixty feet high [1043], and upwards.

"2. The leaves of the tropical grasses are broader, and approach more in form to those of the other families of plants. Of this Paspalus affords many examples.

"3. Separated flowers are more frequent in the tropical grasses. Zea, Sorghum, Andropogon, Olyra, Anthistiria, Ischæmum, Ægilops, and many other genera, which only occur in the torrid zone, and are there found in perfection, are monœcious or polygamous. Holcus is perhaps the only extra-tropical genus, with separate flowers.

"4. The flowers are softer, more downy, and elegant [§ 71].

"5. The extra-tropical grasses, on the contrary, far surpass the tropical in respect of the number of individuals. That compact grassy turf, which, especially in the colder parts of the temperate zones, in spring and summer, composes the green meadows and pastures, is almost entirely wanting in the torrid zone. The grasses there do not grow crowded together, but, like other plants, more dispersed. Already, in the southern parts of Europe, the assimilation to the warmer regions, in this respect, is by no means inconsiderable. Arundo Donax, by its height, reminds us of the Bamboo; Saccharum Ravennæ, S. Teneriffæ, Imperata arundinacea, Lagurus ovatus, Lygeum spartum, and the species of Stipa, by their soft, downy, elegant flowers; and the species of Andropogon, Ægilops, &c. by separate flowers, exhibit tropical qualities. The grasses are also less gregarious, and meadows seldomer occur in the south than in the north of Europe.

As to what relates to the distribution of individuals, the generality of species are social plants.

(1064.) "Lastly. Do we wish to know how this family is distributed, in respect of the number of species, and where they reach their maxima and minima? The following materials may supply, not indeed either a complete or faithful representation, because the grasses are not treated of by botanists or travellers in

general with the same care as the other families, but they will at least give some hints towards effecting that object. In Persoon's Synopsis, the grasses of the torrid zone form $\frac{1}{25}$, and those of the temperate zone $\frac{1}{22}$ of the whole vegetation; but, when it is considered that the grasses of the former have been less investigated than the European, the quotient would be nearly alike in both zones. In the systems of Ræmer and Schultes, tropical are to the European grasses as two to three; but this, from a probable conjecture, is also the proportion of all tropical and extra-tropical plants. In Persoon's Synopsis it is one to two; and, since the publication of that work, the knowledge of the tropical has been enlarged in a greater proportion than that of the extra-tropical plants. Although, however, the quotients in the torrid and temperate zones may be nearly equal upon the whole, when taken in subdivisions there will be an inequality. In the warm regions of South America, the grasses under 200 toises elevation, form from $\frac{1}{15}$ to $\frac{1}{16}$ of the whole; in the West Indies $\frac{1}{17}$; on the river Essequibo, in Zugana, $\frac{1}{12}$ to $\frac{1}{15}$; on the river Congo $\frac{1}{12}$ to $\frac{1}{13}$; in Guyana $\frac{1}{10}$; (in the last three the local circumstances are peculiarly favorable for the grasses;) in the East Indies, according to Brown, $\frac{1}{12}$; in Arabia $\frac{1}{7}$; and in tropical New Holland $\frac{1}{10}$ to $\frac{1}{11}$. Now, attending to the circumstance that tropical are scarcely so well known as other phanerogamic plants, it is not improbable that the true quotient for the torrid zone is $\frac{1}{10}$ to $\frac{1}{12}$. In the warmer parts of the temperate zone the grasses appear to form a smaller proportion of the vegetation; for, in the extra-tropical parts of New Holland they form from $\frac{1}{24}$ to $\frac{1}{25}$, at the Cape $\frac{1}{35}$, in Greece $\frac{1}{15}$ to $\frac{1}{16}$, in the Canary Islands $\frac{1}{12}$ to $\frac{1}{13}$, in the Crimea and Caucasus $\frac{1}{14}$ to $\frac{1}{15}$, in Naples $\frac{1}{11}$ to $\frac{1}{12}$, in France $\frac{1}{13}$, and in Egypt (where, however, the circumstances are peculiarly favorable,) $\frac{1}{8}$. Farther north the relative numbers seem to rise somewhat higher; in Germany $\frac{1}{13}$, in Great Britain $\frac{1}{11}$ to $\frac{1}{12}$, in Denmark $\frac{1}{10}$ to $\frac{1}{11}$, in Scandinavia $\frac{1}{10}$ to $\frac{1}{11}$, in Kamschatka $\frac{1}{7}$ to $\frac{1}{8}$, Lapland $\frac{1}{10}$, Iceland $\frac{1}{8}$ to $\frac{1}{9}$, Greenland $\frac{1}{8}$ to $\frac{1}{9}$, and in North America, according to Pursh, $\frac{1}{14}$ to $\frac{1}{15}$. We may assume, perhaps, as a medium for the warmer parts of the temperate zone, $\frac{1}{12}$ to $\frac{1}{14}$; for the colder, together with the polar regions, $\frac{1}{8}$ to $\frac{1}{10}$. That almost in every flora the quotient is considerably higher than in the works of Persoon, and of Ræmer, and Schultes, affords another proof that, in the rule, the distribution of the grasses is more extensive than that of the other phanerogamic plants. In Southern Europe the number of the grasses seems to diminish according to the elevation, for in the Alpine Flora they are only $\frac{1}{18}$. Their distribution according to elevation does not, therefore, agree with that acording to the latitude; in South America the agreement is greater, for the relative numbers are 0 to 200 toises, $\frac{1}{15}$ to $\frac{1}{16}$; 200 to 1100 toises, $\frac{1}{15}$ to $\frac{1}{16}$; 1100 to 1600 toises, $\frac{1}{11}$; above 1600 toises, $\frac{1}{14}$."

(1065.) A detailed representation of the distribution of the cultivated Gramina would certainly be very interesting. Here we must restrict ourselves to a short general outline. We shall endeavour to specify those Gramina which are the prevailing ones in the large zones and continents, mentioning, in passing, those plants of other families which either supply the place of, or are associated with, the different kinds of grain, as the chief articles of food. This distribution is determined, not merely by climate, but depends on the civilization, industry, and traffic of the people, and often on historical events.

"Within the northern polar circle, agriculture is found only in a few places. In Siberia, grain reaches at the utmost only to 60°; in the eastern parts, scarcely

above 55°; and in Kamschatka there is no agriculture, even in the most southern parts (51°.) The polar limit of agriculture on the north-west coast of America appears to be somewhat higher; for, in the more southern Russian possessions, (57° to 58°,) barley and rye come to maturity. On the eastern coast of America it is scarcely above 50° to 52°. Only in Europe, namely Lapland, does the polar limit reach an unusually high latitude, (70°.) Beyond this, dried fish, and here and there potatoes, supply the place of grain. The grains which extend farthest to the north of Europe are barley and oats. These, which in the milder climates are not used for bread, afford to the inhabitants of the northern parts of Norway and Sweden, of a part of Siberia and Scotland, their chief vegetable nourishment.

"Rye is the next which becomes associated with these. This is the prevailing grain in a great part of the northern temperate zone, namely, on the south of Sweden and Norway, Denmark, and in all the lands bordering on the Baltic, the north of Germany, and part of Siberia. In the latter, another very nutritious grain, buck-wheat, is very frequently cultivated. In the zone where rye prevails wheat is also generally to be found, barley being here chiefly cultivated for the manufacture of beer, and oats supplying food for horses.

"To these there follows a zone in Europe and Western Asia, where rye lessens, or disappears, and wheat almost exclusively furnishes bread. The middle or the south of France, England, part of Scotland, a part of Germany, Hungary, the Crimea, and Caucasus, as also the lands of Middle Asia, where agriculture is followed, belong to this zone. Here the vine is also found; wine supplants the use of beer, and barley is consequently less raised.

"Next comes a district where wheat still abounds, but no longer exclusively furnishes bread; rice and maize becoming frequent. To this zone belong Portugal, Spain, part of France on the Mediterranean, Italy, and Greece; further, the countries of the East, Persia, Northern India, Arabia, Egypt, Nubia, Barbary, and the Canary Islands; in these latter countries, however, the culture of maize or rice, towards the south, is always more considerable; and in some of them several kinds of Sorghum (Doura), and Poa Abyssinica, come to be added. In both these regions of wheat, rye only occurs at considerable elevations; oats, however, more seldom, and at last entirely disappear; barley affording food for horses and mules.

"In the eastern part of the temperate zone of the old continent, in China, and Japan, our northern kinds of grain are very unfrequent, and rice is found to predominate. The cause of this difference between the east and the west of the old continent appears to be in the manners and peculiarities of the people. In North America, wheat and rye grow as in Europe, but more sparingly. Maize is more reared in the western than in the old world; and rice predominates in the southern provinces of the United States.

"In the torrid zone, maize predominates in America, rice in Asia, and both these grains in nearly equal quantity in Africa. The cause of this distribution is, without doubt, historical; for Asia is the native country of rice, and America of maize. In some situations, especially in the neighbourhood of the tropics, wheat is also met with, but always subordinate to other kinds of grain. Besides rice and maize, there are in the torrid zone several kinds of grain, as well as other plants, which supply the inhabitants with food, either used along with them, or

entirely occupying their place. Such are, in the new continent, Yams (Dioscorea alata), the Manihot (Jatropha manihot), and the Batatas (Convolvulus batatas,) the root of which, and the fruit of the Pisang (Bananæ, Musæ sp), furnish universal articles of food. In the same zone in Africa, Doura (Sorghum,) Pisang, Manihot, Yams and Arachis hypogæa. In the East Indies, and on the Indian Islands, Eleusine coracana, E. stricta, Panicum frumentaceum, several Palms and Cycadeæ, which produce the sago, Pisang, Yams, Batatas, and the bread-fruit (Artocarpus incisa.) In the islands of the South Sea grain of every kind disappears, its place being supplied by the bread-fruit tree, the Pisang, and Tacca pinnatifida. In the tropical parts of New Holland there is no agriculture, the inhabitants living on the sago of various palms, and some species of Arum.

In the highlands of South America there is a distribution similar to that of the degrees of latitude. Maize indeed grows to the height of 7,200 feet above the level of the sea, but only predominates between 3000 and 6000 of elevation. Below 3000 feet it is associated with the pisang and the above mentioned vegetables, while, from 6000 to 9260 feet, the European grains abound,—wheat in the lower regions, and rye and barley in the higher: along with which, *Chenopodium Quinoa,* as a nutritious plant, must be enumerated. Potatoes alone are cultivated from 9260 to 12,300 feet.

"To the south of the tropic of Capricorn, wherever agriculture is practised, considerable resemblance with the northern temperate zone may be observed. In the southern parts of Brazil, in Buenos Ayres, Chili, at the Cape of Good Hope, and in the temperate zone of New Holland, wheat predominates; barley, however, and rye, make their appearance in the southernmost parts of these countries and in Van Diemen's Land. In New Zealand the culture of wheat is said to have been tried with success; but the inhabitants avail themselves of the *Acrostichum furcatum,* as the main article of sustenance.

"Hence it appears that, in respect of the predominating kinds of grain, the earth may be divided into five grand divisions or kingdoms. The kingdom of rice, of maize, of wheat, of rye, and lastly, of barley and oats. The first three are the most extensive: the maize has the greatest range of temperature, but rice may be considered as supporting the largest number of the human race." (Abridged from Schouw's Grundzüge einer Allgemeinen Pflanzen-Geographie, in Jameson's Edinburgh Journal, April 1825.)

(1066.) The special topography of the grasses is no less interesting than their general distribution; but of their stations little remains to be said, as their chief localities have been already given when treating of the various types and sections. It must then have been observed, that, although there are both land and water-grasses, the aquatic gramina are none of them marine; and that, although occurring in every soil, sand is unfavorable to the growth of the majority; the maritime species, and those found in sabulous districts, being nearly peculiar to such situations. Some of them are social, some solitary plants, and amongst the former many are so gregarious and so intolerant of other plants, that they cover, to

the exclusion of most other vegetables, very extensive tracts of land. The bowling-green-like *pampas*, in the vicinity of Buenos Ayres, form a part of what is there called 'the region of grass,' several hundred miles in extent; and so abundant are herbaceous, and so scarce arborescent plants, that flocks are worth less than fuel, and horses of less value than the firewood they carry.

(1067.) As certain soils are alone affected by certain grasses, or at least are most favorable to their growth and increase, so these grasses, in their turn, become often indicative of the physical conditions of the places in which they abound: not only being more or less certain signs of the nature of the soil, whether chalk, or sand, or clay, but also of the healthiness or insalubrity of their several localities. Thus *Festuca ovina*, *Poa ovina*, *P. alpina*, and other viviparous grasses, are found most frequently, and in the greatest profusion, on exposed highlands, while the *Glyceriæ*, *Arundo Phragmites*, &c. as constantly abound in swampy districts. Hence the former, even when in lowland pastures, and not on elevated downs, are natural indications of a dry, and probably a healthy district; while the latter, on the contrary, even should the bogs have been dried up by the heat of summer, are as sure monitors of damp, and probably unhealthy places, where malaria exists, and where remittent and intermittent fevers are likely to prevail.

(1068.) The great importance of the grasses, and the extreme solicitude of nature for their preservation, is constantly apparent: not only is it seen in the constitutional peculiarities impressed on various tribes, to fit them for various latitudes and soils, but also in the compensating powers with which they are so wonderfully provided, that they are enabled to resist accidental injuries, and to overcome many external local disadvantages, that would seem, at first sight, to be insuperable. Thus, for example, the more the leaves of grasses are consumed and their flowering culms destroyed, the more they propagate themselves by offsets from their roots. Furthermore, graminivorous animals in general prefer the foliage to the culms, which thus are often left to ripen their seeds: or even, if trodden down, they are not destroyed, for roots are protruded from the nodi; and the plants in pastures are thus inconceivably multiplied by layers. On exposed downs and alpine grass-lands, where the heat is often insufficient to ripen the seeds, or if ripened, where the winds would bear them away from the mountain-sides, few are found to flower; but, as before observed, the viviparous

species and varieties prevail. The final cause of this arrangement would seem to be twofold, although both are so mutually dependent that they are separable only in idea. In the first place, to insure the preservation and propagation of the plants themselves, which are to form pastures and to afford food for the chamois and the mountain-sheep and goat; and, in the second, to keep the vegetable mould, essential for their own subsistence, from being blown by winds, or washed by torrents from the shelving hills into the vales below. This is done by the wide-spreading roots and subterranean suckers of these alpine grasses, the necessary consequence of the abortion of their seeds and their viviparous multiplication: for a living network is thus produced by their interwoven ramifications which encompasses the hills, and covers their sloping sides, with-holding the earth as within a web, thus restraining their degradation; and hence being, although primarily reproductive, no less important in their secondary conservative design.

(1069.) The sand-grasses, and sand-sedges, so abundant on our sea-coasts, are exposed to equal difficulties with their alpine associates, in the ripening their seeds, and the retention of them, when ripened, on the shore, for the constant winds that prevail would either carry them inland, or cast them into the sea. These grasses therefore increase also by their subterranean shoots; and an equivalent secondary service is likewise here fulfilled to that which is performed by the viviparous grasses of the highlands: for the vast banks of sand which are washed up by the sea upon many coasts, and which, when blown inland, deluge corn-fields and pasture-lands, converting fertile districts into deserts, are restrained as soon as the *Elymus arenarius*, the *Carex arenaria*, and their fellow-labourers, colonize these tracts. The long fibrous downy creeping roots fix the loose and flowing sands, which would otherwise advance with fatal sureness. Much land has been thus overwhelmed on the Biscayan shores: in Egypt vast tracts of fertile country have been thus converted into deserts: near Downham, in Suffolk, the sand-floods have encroached five miles within the last century; and in Scotland hundreds of acres have been utterly destroyed. The Coubin estate, near Fores, which once was worth 300*l.* per annum, has long been overwhelmed with sand. The fearful inundation in this neighbourhood was in 1769 so rapid in its encroachments that an apple-tree was buried by it during one season, so that only the very summit appeared. This

fatal flood was occasioned by recklessly pulling up the *bent-star* or *mat-grass*, when some trees were cut down. Strange as it must appear, notwithstanding such lamentable ravages, the country people destroy the sea-mat grasses, collecting them for fuel; thus removing their greatest protectors, the natural antagonists of moving sands. To such an extent were they at one time destroyed, that an act of Parliament was passed, rendering their destruction penal. (15 George II. c. 23.) Sand-banks when fixed by the mat-grasses become gradually covered by vegetable mould, and as the sea recedes they gradually migrate to the new formed shores, leaving the richer soil to other species, and fix succeeding banks as they are successively thrown up. The sand-hills on the French coast between Dunkirk and Boulogne, especially about Calais, are covered with these mat-grasses, which keep them firm, and the banks on our Flintshire shores, in the parish of Llanissa, are also similarly fortified. Stillingfleet recommended the sowing of mat-grass, which it is providentially ordained that cattle will not eat, on the sandy wilds of Norfolk, to restrain the deluges of sand to which that county is subject, and with much probability of success, for the Dutch owe the existence of no inconsiderable part of their country to the defensive power of the *murah* or *mat-grasses*, which they call *halm*.

Many other examples of the protecting powers of these plants might be adduced: let one more suffice for present illustration. As the ocean retires from certain shores, it encroaches upon others. The situation of the town of Hull is such, that, in the opinion of those conversant with the subject, it would long since have been washed away, and its site covered by the sea, were it not protected by Spurn-point, which receives the full force of the swell, and breaks its power before it reaches Hull. Spurn-point is a sandbank, at first fixed, and still preserved by the roots of mat-grass.

GEOLOGICAL CONSIDERATIONS.

(1070.) No fossil remains of grasses have hitherto been found in either the secondary or tertiary* formations. Negative evidence is thus adduced of their

* The fossil *Endogenæ*, called Endogenites, Culmites, Poacites, Cyperites, &c. are of very doubtful affinity. Two things only can be affirmed of them with safety, first, that they are the remains of Monocotyledonous plants, and, secondly, that they are not Gramina, or at least, that there is no satisfactory proof of their being such. The last named, which is the most like a fossil sedge of any yet discovered, is figured in Lindley and Hutton's Fossil Flora, pl. 43, fig. 1 and 2; see also the Fossil Palmares, in the following chapter.

absence from the ancient floras of the earth. This is a conclusion that could not have been guessed at; for grasses are now known to form a part, and a very considerable part, of the vegetation of every region of the globe. There are many that flourish directly under the line, and Agrostis algida grows even in Spitzbergen. As none of the grasses are marine, although there are many that are maritime, it was not to be expected that any vestiges should occur among the earliest relics of the Fucales. Even in the coal formation, where representatives of tropical Ferns abound, their absence might not be wholly unsuspected: for, previous to the creation of air-breathing animals, grasses were not required for pasturage, and therefore might be absent; but that there should be none discovered in the upper tertiary beds, where the fossil remains of huge herbivorous beasts are found, does seem extraordinary indeed. It must however be remembered, that some of the largest now existing are browsing, rather than grazing animals.

(1071.) The absence of grasses, from the deposits of epochs in which there flourished palms and pines, and the representatives of many of the so-called more perfect plants, confirms the objection already made to the doctrine of progressive development; and adds another proof to those which have previously been given, of its opposition to facts and to the warrant of experience.

(1072.) The duties which the primæval ferns appear to have performed in the general economy of nature, seem in some measure to explain the late advent of the grasses: for not only would plants, which draw greatly on the soil, have been as it were anachronisms, in an epoch when no vegetable mould was formed, but they would have impeded rather than have furthered the operations then in progress for the purification of the atmosphere, and the consolidation of its superabundant carbon.

(1073.) In the present era, however, the case is wholly changed. Now the myriads of generations of plants and animals that have lived and died, and added their substance to the soil, would be sad incumbrances on the face of this fair world, were there not means devised for rendering the matter they contain, and which is no longer useful to themselves, useful to their survivors. This is done by those plants especially which require rich soil and much manure for their support; and which thus, living on the dead, bring back to us again, in the form of fairest fruits and flowers, the refuse filth, and offal, that are cast upon the dung-heap.

Were it not for such natural transmutators; were matter once eaten, uneatable again; were it not that the present generation lives upon the past, as succeeding generations will live upon the present; were it not that the same atoms are digested over and over again, the whole earth might be in time devoured, and its inhabitants starve, amidst the wreck they had made.

Putrefaction and decay are generally regarded with disgust; and the admirable process of corruption too often turned from with horror. But dissolution is not destruction, and few secrets are more wonderful than those which such a change reveals: for it shews the first and the last of a series of extraordinary events, the earliest and the latest of those mysterious transformations that all organic beings undergo; and by which creatures, old, decrepid, and worn out, are, as it were by natural magic, converted into others young, vigorous, and strong. Thus nature is renewed, and death, so much dreaded as a destroyer, should rather be looked on as the renovator of the world.

OUTLINES OF PALMAROLOGIA.

(1074.) PALMS and LILIES, the *princes* and *patricians* of the vegetable kingdom, as they were once figuratively called by Linnæus, form, with the BANANAS and their immediate allies, an extensive group, to which the most noble individuals it contains have given the common collective name PALMARES.

(1075.) This, which is the sixth class of the present ascending scale, includes all those grain-bearing or one-lobed flowering plants which are not furnished with glumes or husks, but which are either destitute of floral envelopes, or have them arranged in whorls.

(1076.) This disposition of the modified foliage is considered indicative of a higher grade of organization than exists in the sedges and the grasses; and the metamorphosed leaves are therefore no longer called *glumes* or *husks*, but *phylli*, and form, collectively, an organ named the *Empalement* by Grew, the *Perianth* or *Perigone* (Perianthium, perigonium,) by modern writers. But the phylli, besides being developed on the same plane instead of alternating with each other, exhibit a further remarkable change; for, in the vast majority of cases, a part, if not the whole of the Empalement, loses its comparatively coarse foliaceous texture and green hue, and becomes peculiarly delicate and variously coloured. When thus coloured it is said to be petalöid, when green, sepalöid; for, if distinguishable into a double series, the outer is called a *calyx*, and the inner a *corolla*, the modified leaves of the latter being termed petals, of the former, sepals: if not distinguishable into calyx and corolla, the common term, *empalement* or *perianth*, is used; and, if only a single series is evolved, that is called a *perigone*.

(1077.) The tendency which is obvious in all, and confirmed in most, of these plants to develop the floral coverings on the same plane or in whorls, and to convert the rude green *phylli* into a delicately coloured petal-like calyx or corolla, has caused the *Palmares* to be sometimes called *Petalöid Endogenæ*, or *Monocotyledons;* but as several are destitute of perianth, and others are glumaceous, the term conveys a false impression, and is therefore untenable.

(1078.) The PALMS (*Palmæ*), the RUSHES (*Junci*), the LILIES (*Lilia*), and the BANANAS (*Musæ*), give their names to the four orders that are associated to form this class, and which are hence called respectively the PALMALES, the JUNCALES, the LILIALES, and the MUSALES.

(1079.) The MUSALES appear to have fewer points of resemblance to the GRAMINA than either the JUNCALES, PALMALES, or LILIALES. Indeed, the close connexion of the latter with the CYPERALES through *Juncaceæ*, *Restiaceæ*, and *Typhaceæ*, has been already fully dwelt on [§ 1050], and the arborescent grasses have been likewise shewn, frequently, to assume the majestic growth of Palms [§ 1032, 1043]; the Palms also strengthen the similitude by occasionally becoming weak and flexible; such, for example, as the *Calami* or reed-palms, which furnish canes and walking-sticks, similar to the *Bamboos* and *Arundines*, or reed-grasses, whence they were called by Rumphius Palmi-junci or Palm-rushes.

(1080.) Two osculant points are thus observable, one between the *Sedges* and the *Rushes*, the other between the *Grasses* and the *Palms*. It therefore little matters which order is first described; but, as the *Juncales* seem to be in some measure transitional between the *Lilies* and the *Palms;* as the *Liliales* are between the *Bananas* and the *Rushes*, the former of which are the furthest removed from the Graminà, the precedence may perhaps with advantage be yielded to the Palms.

PALMALES.

(1081.) The Palms, exceeding most other plants in size, and surpassing all in grandeur and majesty of port, naturally commanded the earliest attention of mankind; and the innumerable purposes to which their fruit, their leaves, and their stems, have been applied as food, clothing, and shelter, as well as their constant ministration, even in an uncultivated state, to the necessities

of man, have worthily retained for them that regard which their beauty at first excited; and they are therefore still esteemed as

Iriartea ventricosa.

Elais melanococca.

some of the most valuable and important, as well as splendid vegetables known.

(1082.) The Palms were thus soon distinguished as a peculiar race, and designated by a peculiar name, which name and distinction they have ever since maintained: and, although it may be questionable, considering their organs of fructification, whether they should be ranked higher than as a section of the Liliales, yet, deference to established usage, and a consideration of their organs of vegetation, especially their arboreous stems, rigid divided leaves, median ovules, and aberrant embryo, as well as a regard to the botanical canon, which may be extended from genera to all natural associations, that the groups should furnish their own connecting characters, and not differential characters determine their bounds, combine to persuade the systematist to keep the *palms* in an order by themselves, although their strong similitude in various particulars to those which follow is at the same time neither unnoted nor forgotten.

(1083.) The Palms are arborescent Monocotyledons, with gene-

rally simple cylindrical lofty stems, occasionally, but very rarely branched, [§ 1081, 1093.] The rigid flabelliform or pinnati-sected leaves, are large, petiolated, and crowded at the extremities of the trunk or branches, the leaf-stalks partly embrace the stem, are invested with stipulaceous or ochrea-like membranes called reticula, and cover the stipes when they fall with successive series of induviæ or scars; the vernation is plicate, the leaves are non-reticulate, and the structure of the stem decidedly endogenous. The inflorescence is in catkins, or in large clusters or racemes, (called sometimes regimes,) which are furnished with bracteolæ, and often enveloped in large bracteæ or spathæ. The perianth is small and of six pieces, disposed in two series, so as to be equivalent to calyx and corolla, the sepals being often the smallest, and the petals connate. The stamens are rarely three in number, most frequently six, and either separate from, or united with, the pistils, the flowers being both monoclinious, monœcious, diœcious, and polygamous. The styles are three, often connate, stigmata simple, discrete or connate, germen superior, three-celled, two or one of which cells often become abortive, and the locules are one-seeded. The fruit is either a berry or a drupe, with fleshy or fibrous mesocarp; the ovule is attached not to the margin of the carpellary leaf, but springs from the median line, and is either sessile, as in *Chamærops*, or pedicled, as in *Rhapis*. The embryo is small, cylindrical, or turbinate, various in its situation, but usually distant from the hilum, enclosed in a hollow of the albumen, and covered with an operculum; the albumen is cartilaginous, and either ruminated, or with a central, rarely a ventral, cavity; the plumula is scarcely visible, and the cotyledonary end of the embryo greatly enlarged during germination.

(1084.) Thus it will appear that, from most other plants, the palms are distinguished by their in general simple stipites, covered with the remains, or marked by the scars, of successive crowns of leaves; from arboreous ferns in which these characters are present, they are known at once by their flowers, and by the foliage being formed of true leaves traversed by linear veins, and not being fronds bearing fructification on their backs. From *Cycadaceæ* their endogenous structure and covered seeds will separate them with facility, and with other sections there is scarcely any chance of their being confounded.

(1085.) From the above general description, it appears that their arborescent stems, rigid divided leaves, superior ovary, median

ovule, and aberrant included embryo, are the chief differential signs by which the Palms are distinguished from the other non-glumose monocotyledons, with which they are associated to form the present class.

(1086.) Martius, who has studied these plants more sedulously and with more favorable opportunities than most other botanists, estimates the number of existing species at upwards of a thousand, not a fifth part of which have however as yet been discovered or described. This calculation has been impugned by Schouw, but it seems to be confirmed by the observations of Humboldt and Bonpland.

The genera now known have been distributed, by Von Martius, into six subordinate groups, the differential characters of which are not, however, very decided, and they can scarcely be regarded as more than subtypes, associable into two types or subsections, the *Phœniciance* or *Phœnicaceæ*, in which the spathes are numerous and incomplete; and the *Areciance* or *Arecaceæ*, in which, when present, they are complete. Collectively, these two types or subsections form the section Phœnicinæ, the only one included in the order; for present knowledge does not justify a further primary subdivision.

PHŒNICINÆ.

(1087.) *Phœnix dactylifera*, the date, which gives name to this, the single section in the order Palmales, is not improbably the very species to which the term *Palm* was originally applied; for it appears that of these noble plants three only were known to the ancients, viz. the Date, the Doum, and the Fan palms; and the Greek δακτυλος (dactylus), a *finger*, whence the present specific name dactylifera is derived, has a peculiar coincidence with the Latin *palma*, a hand, to the digits of which the bunches of dates were likened, and to which the fruit of neither of the others could have been compared.

(1088.) Phœnicaceæ. All those palms in which the spathes are numerous and incomplete, are included in the type *Phœnicaceæ*, which thus comprehends three or four subtypes, the *Calamidæ*, *Borassidæ*, and *Coryphidæ*, from which latter Von Martius separates the *Sabalidæ*.

(1089.) *Calamidæ. Calamus*, *Mauritia*, *Lepidocaryum*, *Sagus*, and *Raphia* or *Metroxylon*, in which the baccate fruit is covered by a tessellated rind, form the subtype *Calamidæ*. The inflores-

cence in these associated genera is in (catkins, or) amentiform regimes.

Sagus tædigera.

An amentiform regime, shewing the numerous small bracteæ or spathæ, and the baccate fruit with tesselated rind.

(1090.) *Calamus*, the reed-palm, forms the link to which reference has been already made, as connecting this order with the arborescent grasses, to which the several species are very similar in habit, seeming as it were to be gramina with the flowers of palms; the siliceous deposits on their leaves and stems, shew also a further affinity to the grasses.

(1091.) *Calamus scipionum* and *C. rotang* yield the celebrated rattan canes so much prized as walking-sticks, whence indeed is derived the specific name the former bears, in common with the affectionate and noble Roman, P. Cornelius, upon whom his father leant when blind as on a staff, and to whom, as a reward for his dutiful attentions, his fellow-citizens gave the surname *Scipio*.

Calamus rudentum, the cable cane, which is a native of the East Indies, Cochin China, and the Molucca Isles, exceeds in length all other palms, and perhaps is the longest vegetable known, sometimes growing to the almost incredible extent of 500 feet. These, as well as the other species of reed-palms, are applied to a variety of useful purposes. The more slender and flexible are commonly

substituted for ropes and cables, and employed in making wicker-work, hoops, and baskets; the more sturdy for props, poles, and walking-sticks. *C. zalacca* (the Salxck), is cultivated in Java for the sake of its fruit, which is about the size of a walnut, containing two or three sweet kernels, the tessellated rinds of which resemble the scales of a lizard. This palm is believed to yield the red juice which, when inspissated, is called *Dragon's blood;* but the finest is procured from the *C. draco.*

(1092.) The internal structure of the stems of many palms, as well as other plants, is soft and pith-like, and yields a very nutritious farinaceous substance called sago. This substance is particularly abundant in a species of palm called *Metroxylon sagus,* or *Sagus Rumphii.* There are several other species of this genus, as the *viniferum, Ruffia,* and *tædigerum* [§ 1089], all of which afford sago more or less abundantly, and furnish an important article of food to the inhabitants of Japan, and the many other countries in which they grow.

Metroxylon viniferum, of Rottbol, is the Raphia vinifera of other authors; it yields, when wounded, an abundant supply of sap: that in Guinea is fermented into an intoxicating liquor; if evaporated, a honey-like sugar is obtained; and when the acetous fermentation is favored, vinegar is produced from the sap of this, as well as of various other palms.

(1093.) *Borassidæ. Hyphæne, Borassus,* and their various allies, in which the inflorescence is, like the Calamidæ, in amentiform regimes, but in which the pericarps have not a tessellated rind, form the subtype *Borassidæ.*

The three-named *Hyphæne coriacea, Douma,* or *Cucifera Thebaica,* is the Doum-palm of Upper Egypt, and is remarkable for its dichotomous stem, by which it is strongly contrasted with the usual character of the order. It appears to have been known to Theophrastus, who called it *Cuci,* whence Delile's synonyme *Cucifera;* by the Arabians it is called Doum, whence Poiret's word Douma. In the country about Thebes vast forests of these palms are found. Their fruit is about the size of an orange, with a reddish rind; the inner parts are white and spongy, rather insipid, tasting a little like stale bread; they form a common article of food with the wandering tribes of Arabs.

Borassus flabelliformis is a very handsome palm, the fruit of which is as large as a child's head, and the stem, when wounded, yields a sap whence sugar may be procured, and which is frequently

fermented into wine. By *Gomutus saccharifer*, the Areng palm, sugar and wine are also produced.

A. Entire plant of Douma Thebaica, to shew its dichotomous stem. B. Amentiform regime of stamineous flowers. C. One flower isolated, shewing perianth and stamens. D. Bunch of fruit. E, F. Back and front view of the three ovaries. G. Fruit, one ovary perfected, two abortive. H. Vertical section of developed fruit. I. The nucleus. J. The embryo. K. Ditto cut lengthwise.

(1094.) *Coryphidæ.* *Corypha*, *Phœnix*, *Rhapis*, and their allies, *Sabal*, *Thrinax*, *Iriartea*, *Ceroxylon*, and *Chamædora*, although agreeing with the two preceding subtypes in having their spathæ numerous and incomplete, do not flower in amentiform regimes, and hence they are associated in the subtype *Coryphidæ;* and those genera in which the pistils are discrete have been distinguished from those in which they are coherent under the name *Sabalidæ:* the distinction, however, seems scarcely necessary.

(1095.) *Corypha umbraculifera*, the majestic Talipot palm of Ceylon, has been already figured in the general Outline, [§ 81.] Knox, in his History of Ceylon, describes this palm to be—

" As big and as tall as a ship's mast, and very straight. The leaves, which are very large, some capacious enough to cover from fifteen or twenty to thirty or forty men; these, he says, are of great use, for being, when dried, very strong and limber, though very broad when open, yet they will fold close like fans, and are then no bigger than a man's arm. The whole leaf-spread is round, but it is cut

into triangular pieces for use; these the natives lay upon their heads when they travel, with the narrow end foremost to make their way through thickets. The soldiers there all carry these umbrellas, not only to shade them from the sun and to keep them dry in case of rain on their march, but when set on-end, to make tents for them to lie under. A magnificent crown of leaves, as is usual with palms, terminates the stately column, 100 feet in height, which is formed by the trunk. The talipot bears no fruit until the last year of its life, and then yellow blossoms, most lovely to behold, but smelling very strong, come out on the top, and spread abroad in great branches; the fruit is in such abundance that one palm will yield seed enough to stock a whole country; the berries are round and hard, the size of our largest cherries, but not good to eat. The flowers smell so strongly that the Ceylonese cut the palms down, when growing near their houses, before the blossoms are open. The trunks when young are full of a mealy pith-like substance, which is beaten in mortars, and cakes made of it, that have very much the taste of ordinary white bread. The leaves are used instead of thatch for roofing houses, and also for writing on with an iron style. Most of the books shewn in Europe for the Egyptian papyrus are made from the leaves of this palm. In Malabar it is called Codda Panna, and very good figures are given in Rheede's Hortus Malabaricus."

Corypha Taliera is another magnificent species growing in the northern parts of India, and applied to many of the same economical purposes as the talipot is in Ceylon; C. rotundifolia yields an amylaceous food, or kind of sago. The fruit of C. Pumos is eatable, and is sweet, and dogs are fed upon it in Mexico: and *Corypha cerifera*, which is a native of Brazil, receives its specific name from the wax-like matter it affords.

(1096.) *Phœnicia* formerly produced the best dates known, the date-palm was hence called *Phœnix*. It grows abundantly in Egypt, Arabia, Persia, and the neighbouring countries, and contributes largely to the support of the inhabitants, being in many places, as in Upper Egypt, the chief source of food.

The Date-palms being diœcious, (*i. e.* the stamens and pistils being not only in separate flowers, but growing on different trees,) the crops entirely fail, or the fruit is degenerate and unfit for food, if unseasonable weather, or any accident, should prevent the pollen of the stamineous plants having access to the flowers of the fruit-bearing ones. To ensure the fertilization of the seeds the Arabs have long been accustomed to gather the stamineous clusters and hang them over the pistilliferous flowers, and even to lay up stores of pollen from year to year. At the season when this is done a feast is held, called the Marriage of the Palms, of which Haselquist has given a very interesting account; and it is stated, that so well do the half-savage tribes know the importance of this process, that, during inroads into hostile countries, they cut down the stamen-bearing palms, as one of the most severe injuries they can inflict. Desfontaines was witness

to such an act of vengeance, and Kœmpfer relates that the threat of so doing once warded off an invasion; for, after describing the artificial fecundation of the date, he adds:

"I remember it happened in my time that the Grand Signior meditated an invasion of the city and territory of Bassora, which the prince of the country prevented, by giving out that he would destroy all the male palm-trees on the first approach of the enemy, and by that means cut off from them all supplies of food during the siege."


Phœnix dactylifera.

The extensive importance of the date-tree is, says Dr. Clarke, one of the most curious subjects to which a traveller can direct his attention. A considerable part of the inhabitants of Egypt, Arabia, and Persia, subsist almost entirely on its fruit; as a luxury they make a conserve of it, and they boast also of its medicinal virtues, esteeming it a tonic. Upon the abortive fruit and upon the ground-date stones, the camels are fed. From the leaves they make couches, baskets, bags, mats, brushes, and fly-flaps; from the trunk cages for their poultry, and fences for their gardens, and other parts of the tree furnish fuel. From the fibrous webs at the bases of the leaves, thread is procured which is twisted into ropes and rigging, and from the sap, which is collected by cutting off the head of the palm and scooping out a hollow in its stem, a spirituous liquor is prepared. Three or four quarts of sap may be obtained daily from a single palm for ten days or a fortnight, after which the quantity lessens, until, at the end of six weeks or two months, the stem is exhausted. So numerous being the uses of this palm, it is no wonder that it is highly prized, or that the native literati should have celebrated in verse and prose (as Gibbon informs us), the 360 uses to which the trunk, the stalks, the leaves, the juice, and the fruit, have been skilfully applied.

A single date-palm will bear upwards of a hundred-weight, and sometimes between two and three hundred-weight of dates in a season; they come into bearing at from six to ten years of age, and are fruitful for upwards of two hundred years. The amylaceous central part of the trunk is also good to eat, and the buds are esteemed a delicate vegetable. The young shoots are said to resemble asparagus.

The fruit of the *Phœnix farinifera* is eaten by the natives on the Coromandel coast, and from its trunk they procure a farinaceous substance resembling sago, but very inferior to that afforded by the Sagus.

The trunks of the palms being unbranched, and for the most part cylinders of

no great diameter, although some, as the Elais butyracea and Jubæa spectabilis, are three or even five feet thick, and their crowns of leaves being terminal, the wind has vast power over them, and the French, while in Egypt, are said to have applied this force to a very useful purpose, viz. to pump up the waters of the Nile, making them as it were levers to raise the pistons which fell again by their own weight.

Tamar is the Arabian name for the date, and critics suppose that *Tamar* (Ezek. xlvii. 19,) or *Tadmor* (1 Kings, ix. 18,) in the Wilderness, was so called from the abundance of palm-trees in the neighbourhood, whence the city was subsequently named by the Romans *Palmyra,* and both Wood and Bryant assert that it is still called Tadmor or Tedmor, by the Arabs, as it was by the Syrians in the time of Josephus.

Iriartea is an interesting genus, in which several of the species have their columnar stipites elevated on unearthed roots, as *I. exorhiza* and *I. ventricosa* [§ 1801], in which latter the stem becomes naturally tumid. The *Ceroxylon andicola* of Humboldt, which is now made a species of *Iriartea*, excretes a wax-like matter on its foliage, whence it has received its name.

(1097.) Arecaceæ. *Areca*, the betel-nut, and *Cocos*, the cocoa-nut, with various other genera in which the spathes when present are complete, form, collectively, the type *Arecaceæ*. This group has been distributed into two subtypes, the Arecidæ and Cocoidæ, the former of which, according to Von Martius, has a one-seeded berry; and the latter a one to three-seeded drupe: in the latter the complete spathes are always present, in the former they are often wanting. The distinction between the baccate and drupaceous pericarps is not, however, very decided in the palms, and therefore the subtypes are not here introduced.

There are several species of Areca, the best known of which is the A. catechu, as it affords the betel-nut, so much resorted to for its intoxicating and narcotic powers, [§ 75, fig. A.] This is almost the only palm which does not yield sago; but from its fruit an astringent extract is procured, that is brought into the market as an inferior sort of catechu. Slices of the betel-nut wrapped in a leaf of the betel pepper is a favorite masticatory in southern Asia. A little shell-lime is added to keep the taste and odour longer in the mouth. It gives the saliva a red hue like that of blood, and by constant use the teeth become blackened; it allays hunger, and is hence chewed, as tobacco is in Europe, to appease the appetite; and it is said to be considered the height of rudeness in the East to speak to a superior without having *a quid* of betel in the mouth, (Loudon.) It produces intoxication when first chewed, but this effect is soon got

over, and the natives say that it is a tonic, and moderates profuse perspiration.

Areca oleracea, the cabbage-palm, of the West Indies and the American continent, has so been called from the young bud being eaten by epicures, as coleworts are with us. This is one of the noblest of the American palms, rising sometimes to the height of 170 or 200 feet, and having a straight columnar stem of about seven feet in circumference. The fruit yields oil, the stem an inferior sort of sago, and the fibrous parts of the leaves are spun as hemp or flax, and made into fishing-nets and cordage of every kind.

(1098.) The *Cocoa-nut*, like the date-palm, is most eminently useful, and, like it, in the highest degree serviceable in the countries in which it grows; indeed, the history of the one is in great measure a counterpart of that of the other.

The stem when young affords a farinaceous food, when old the outer parts become so hard that swords and arrows are made of it, which it is said will pierce iron cuirasses. Sections of the stem are made into drums; and this curious timber is used in building houses and for various domestic purposes. The fibres of the leaves as well as the bastin of the pericarp are spun into thread, and cords, cables, cloth, &c. made from them. It is from this substance that coarse cloths and some of the more costly carpets are manufactured. The bases of the leaf-stalks and the *retinacula*, which are a modification of *ochreæ*, resembling coarse gauze, are used by the Indians as cradles and coverlets, the midribs are converted into oars, and the leaves furnish thatch, fences, and fuel, and when burnt they yield potash. The nuts afford an abundance of food; and the unopened buds are esteemed as a delicacy. The sap which exudes from the stem when the buds are cut off contains a large quantity of sugar, which may be separated by boiling, and is called Jaggery, or the sap may be fermented into an intoxicating liquor, whence the Pariah arrack is obtained by distillation. The unfermented sap is a grateful and wholesome beverage, and is regularly brought in large quantities to the markets, and sold under the name of *Toddy*. Ainslie recommends it to Europeans, especially delicate females, as the easiest and safest means of obviating or removing constipation. The milk of the young cocoa-nuts is a most refreshing drink; when old, it is thickened into a sort of cream, and subsequently,

a firm but hollow kernel is produced, which yields abundance of oil. This oil has lately become an important article of commerce; and even the nutshells are converted into cups, saucers, plates, dishes, mugs, bottles, boxes, rings, and a variety of articles both useful and ornamental.

Cocos capitata is a very handsome Brazilian palm; and another species of *Cocos*, the *aculeata*, is believed to yield the best palm-oil. It is, however, probable that palm-oil is obtained from several species as the Cocos butyracea or Elaeis guineensis, especially as the greatest quantities imported come from Africa, where it is used as freely by the negroes as olive-oil is by the Italians and Spaniards, their fish and rice being steeped in it, and their bodies anointed with it continually.

Cocos capitata.

(1099.) Numerous other palms, besides those already mentioned, yield wine, milk, cream, oil, butter, wax, resin, flour, sugar, salt, thread, cords, bows, arrows, and various other articles of food, medicine, furniture, and clothing to the natives of the countries in which they grow; but the above will afford sufficient illustrations of this order; and therefore much collateral matter, not immediately relevant, is suppressed, the introduction of which would be inconsistent with the brevity studied in these general Outlines.

JUNCALES.

(1100.) The rushes (*Junci*), and their allies, the rope-rushes (*Restiaceæ*), with the bur-reeds and reed-mace (*Typhinæ*), and other non-glumose monocotyledons, having naked flowers, or glumaceous perianths, and superior carpella, form the order Jun-

CALES, which seems to be in some measure intermediate between the *grasses* and the *sedges* on the one hand, and the *palms* and *lilies* on the other. The glumaceous perianths and albuminous seeds of the *Juncaceæ* and *Restiaceæ* connect them with the *Gramina* generally, while the included embryo of the rushes, and the excluded of the cord-rushes, are analogous to the included and excluded embryo in the grasses and the sedges. The foliage of these plants is also similar to that of the grasses, and hence they once were named *Vegetabilia graminifolia.*

(1101.) The rushes are on all hands acknowledged, by their pith-bearing stems, hexaphyllous perianths, and large firm, fleshy, or cartilaginous albumen, with included embryo, to evince a stronger affinity to the palms than is shewn by any other group, while the spathæ, spadices, and amentiform inflorescence of the palms, establish a secondary connexion between them and the spadiceous and spathaceous Typhaceæ, Callaceæ, and other types of the Juncales. The glumaceous perianths of some Juncaceæ approximate them to the semipetaloid types of the *Liliales*, while the exalbuminous seeds of the *Nayadinæ* and part of the *Acorinæ*, with the palmate or pedatinerved leaves of the *Callaceæ*, shew how many points of connexion exist between this and the following order, the LILIALES, *e. g.* in the *Dioscoraceæ*, *Smilaceæ*, and *Hydrocharinæ.*

(1102.) The several subordinate groups of rushes and rush-like plants associated to form the order *Juncales*, are distributable into four sections, which, from the respective normal genera *Typha*, *Acorus*, *Nayas*, and *Juncus*, are called the JUNCINÆ, NAYADINÆ, ACORINÆ, and TYPHINÆ.

TYPHINÆ.

1103. The floreeds (*Typhaceæ*), so called from the glumaceous scales when present being verticillate, and thus forming a calyx, constitute, with the screw-pines, (*Pandanaceæ*,) the section TYPHINÆ. This section contains very few genera, it has nevertheless been necessarily divided into two types, which differ, not only in their arboreous and herbaceous habits, but also in several important points of structure, viz. their respectively achlamydeous and mono-chlamydeous flowers, their multiple and simple fruits, erect and pendulous ovula, and entire and cleft embryos; the former being the differential characters of the *Pandanaceæ*, the latter of the *Typhaceæ.*

A. Creeping rhizoma of Typha latifolia. (*a*) Rootlets. (*b*) Leaves.

C. Culm with sheathing leaf-stalk (*a*). The phylloideous expansion (*b*).

B. Spadiciform inflorescence. (*a*) The lower pistilline flowers. (*b*) The upper stamineous ones.

D. Spike of Typha angustifolia, in which the predominant axial force has elongated the stem, and separated the pistilline flowers (*a*), from the stamineous ones (*b*), by the space (*c*).

E. Another spike, in which the same abnormal development has occurred in a still greater degree.

F. Stamineous flowers separated.

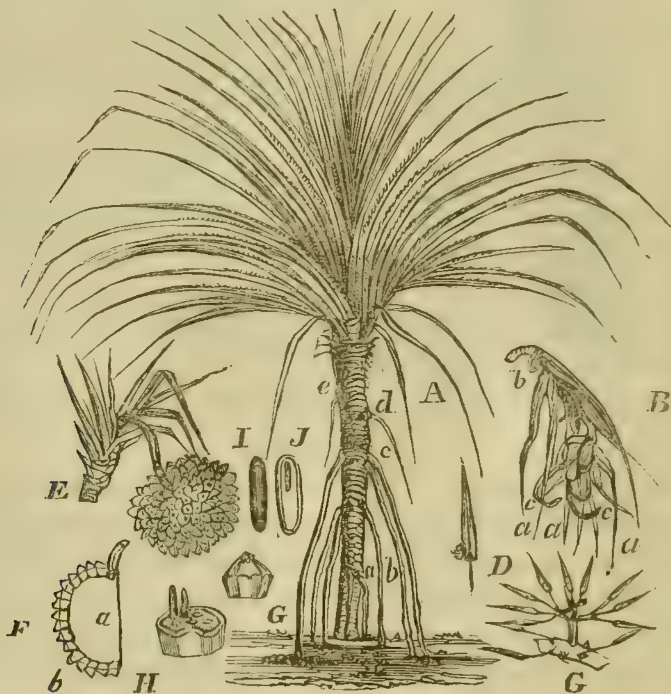
G. Pistilline ones.

(1104.) Pandanaceæ. The screw-pine, *Pandanus*, with its allies, *Freycenetia*, *Cyclanthus*, and *Phytelephas* or *Elephantusia*, agree in having multiple fruit, erect ovules, and uncleft embryos; but they differ in having the former simple, and the latter divided leaves, the former absolutely achlamydeous flowers and discrete carpellæ, the latter an obscure glumaceous perianth, and the inflorescence spiral. Hence this type, small as it is, appears to require subdivision, for *Cyclanthus* and *Phytelephas*, by their possession of spathæ and their large frond-like divided leaves, approach more closely to the palms than do the screw-pines, and hence two subtypes may be distinguished, viz. the *Cyclanthidæ* and *Pandanidæ*.

(1105.) *Cyclanthidæ*. The fruit of the Cyclanthi is remarkable for its size; that of *Phytelephas*, or the Tagua plant, for the hardness of its albumen, whence buttons are turned. Both genera, and all the known species, are natives of America; but they are none of them very important in an economical point of view.

(1106.) *Pandanidæ*. The *Pandani*, like some of the *Cyclanthidæ*, are many of them arborescent plants, and are remarkable for their tendency to branch; an anticipation of which occurs in the Doum palm, although such a disposition is rare in the Endogenæ. *Pandanus candelabrum*, the Chandelier-tree of Guinea, has received its name from this natural peculiarity. The leaves are long, rigid, and undivided, and arranged spirally round the stem, or branches, whence they have been called screw-pines.

Pandanus odoratissimus, as well as other species of this genus, exhibit a strange semblance of instinct, in the development of aerial roots at different distances on their stem, by which their life is prolonged; and the fate common to most of the arborescent endogenæ for a time avoided. It is very curious to observe



A. Pandanus odoratissimus, entire plant, shewing the crown of foliage, and (a, b, c), subsidiary roots, protruded at different heights and periods. (d, e), young rootlets not yet having reached the ground. B. Stamineous flowers, (c, c, c), crowded in spadices (b), and furnished with spathæ (a, a, a). G. Stamineous flower separate. D. A stamen dehiscing and expelling the pollen. E. Globular ament of pistilline flowers in fruit. F. Section of the fruit, shewing (a), the succulent receptacle, or spadix. (b), the carpels. G. A pericarp isolated. H. Horizontal section of the same, shewing the cells or locules, and the seeds. I. A seed isolated. J. A section to shew the situation of the embryo within the perisperm.

the device of nature to strengthen the stem, and to prolong the existence of these handsome plants. Being endogenous, the older and harder formations are outermost. But the diameter of the stem first formed being comparatively small, the outward wall has not had time to harden sufficiently to resist rupture by the descent of the root-fibres from the buds, as in the palms ; and hence a swelling is perceived which subsequently rises into a tumour, and the roots, denied a passage downwards within the stem, descend externally from different distances to the earth; and thus not only strengthen the plant mechanically, but draw uncontrolled supplies of nourishment from the soil, their connexion with which would otherwise, from the peculiarity of their structure, have been cut off prematurely.

(1107.) *Pandanus odoratissimus*, the *Pandang*, of the Malays, grows abund-

antly in most of the warmer parts of Asia. It is a handsome arborescent plant, with shining dark-green leaves edged with prickles, and it is commonly planted in hedge-rows. The staminiferous flowers are delightfully fragrant, and are said to yield one of the richest perfumes known, for the sake of which this Pandang is cultivated in Japan. The soft bases of the leaves and the pulpy part of the fruit, although unpleasant, are eatable, and the Asiatics feed on them in seasons of scarcity; at other times they give them to their cattle as fodder. The soft spongy roots are used instead of corks; the fibrous leaves and stem are made into mats and baskets by the Tahitians, who stain them of different colours; they are also used for thatching and for cordage, and are made into a coarse kind of sacking. The bags in which coffee is brought to this country are for the most part made from the leaf-fibres of these plants. The fruit of *P. edulis* is esculent, and the terminal buds of *P. humilis* and *P. polycephalus* are esteemed, like those of palms, as food. The *Faquahiac,* which Mungo Park found in the interior of Africa, the fruit of which, he says, when ripe explodes and inflames spontaneously, by which many serious accidents have occurred, has been ascertained by M. Beaufort to be a species of Pandanus, who confirms Park's description.

(1108.) TYPHACEÆ. The reed-mace (*Typha*), and the bur-reed (*Sparganium*), form, together, a small type named the *Typhaceæ,*

Sparganium simplex.

A. Flowering stem, with *a, a, a,* pistilline flowers below; *b, b, b,* the stamineous ones.

B. A clavate or club-shaped stamen, with long lax filament.

which is closely allied to the *Cyperales,* especially to the section *Caricinæ:* for in the stamineous flowers the scales of the perianth are irregular or scarcely whorled, but in the pistilline ones the sepals are verticillate; and hence the type is removed from the *Gramina,* and combined with the glumaceous *Juncales.*

(1109.) The *Typhaceæ* differentially considered are subglumaceous monocotyledons, with triandrous separate flowers, and lax

filaments, single superior ovary, pendulous solitary ovule, and cleft embryo.

(1110.) The Typhaceæ are all aquatic or marshy plants, with perennial rhizomata; stems, round or angular; leaves (phyllodia) simple, with linear venation; inflorescence spicate or capitate; flowers monœcious; perianth subglumaceous or setaceous, stamina three; anthers club-shaped, filaments long and lax, ovarium single, ovule solitary, pendulous; pericarp dry and indehiscent, seed pendulous, albumen farinaceous; embryo straight, with a lateral cleft, and included within the albumen.

(1111.) The Typhaceæ are not very important plants; they are not known to possess any properties different from the ordinary sedges: like them they give an appearance of luxuriance, but afford a poor and scanty fodder to cattle in cold and damp, and otherwise barren situations, preparing the soil for the reception of more nutritious plants. The Typha has received its name from τιφος, a marsh, in allusion to its habitat; and its resemblance to that magisterial emblem of authority, a mace, has entailed on it the appellation reed-*mace*. It is the reed that painters usually figure in the Saviour's hand.

(1112.) The pollen of the Typhæ is inflammable, and is often substituted for the pollen-like dust of the Lycopodia, in pyrotechnic exhibitions. Its abundance and the ease of collecting it, is probably the cause of the substitution, for the pollen of any other plants would answer the same end. This pollen forms a stimulating application serviceable in the cure of indolent sores. The leaves are put by coopers between the staves of their casks to prevent leakage. They are also made into mats, or coarse chair-bottoms, and form good thatch. The downy seeds are used as stuffing for cushions; and in Germany the young roots are eaten in salads.

(1113.) The arborescent *screw-pines* (Pandanaceæ), seem to hold nearly the same relation to the more lowly bur-reeds (Typhaceæ), that the bamboos do to the meadow-grasses; or the arboreous ferns, fossil Equiseta, and Lycopodiaceæ, to the humble European Filices and modern existing genera; for, although the foliage of Pandanus is more similar to that of a pine-apple, whence, with the spiral exsertion of its leaves, the name *screw-pine* has been derived, than to that of the Typhaceæ, still its flowers bear so strong a resemblance to those of the bur-reed, "that it appears, (says Richard,) to be an arborescent species of it." And hence, although typically distinguished, it has been arranged with them in one common section, of which the collective characters are few and simple. They are arborescent or herbaceous Juncales, with subglumaceous or achlamydeous separate flowers, spadiciform inflorescence, solitary ovules, and fleshy or mealy albumen.

ACORINÆ, OR AROIDEÆ.

(1114.) *Arum* (the wake-robin or cuckoo-pint), with its allies, *Acorus*, *Lemna*, *Calla*, and *Orontium*, give evidence of a further progressive change in organization, and of this the types named, from the three latter genera, are the successive grades. The *Lemnaceæ*, *Callaceæ*, and *Orontiaceæ*, form, collectively, the section *Acorinæ*, the *Aroideæ* of many authors.

(1115.) The *Acorinæ*, are either annual or perennial plants, with usually grumous rootstakes, leaves often radical or alternate, inflorescence spadiciform, flowers either separate or united, and either naked or furnished with a perianth; the ovary is in general one-celled, containing several seeds; fruit dry or succulent; seeds mostly albuminous, and the embryo cylindrical and erect.

(1116.) Differentially considered the *Acorinæ* are Juncales with achlamydeous flowers, or squamaceous perianths, furnished with spathæ and albuminous seeds; the albumen being very rarely absent, and the spathæ sometimes leaf-like.

(1117.) ORONTIACEÆ. *Orontium*, *Acorus*, *Dracontium*, and

A. *Acorus Calamus*, and *A. gramineus*. (*a*) Rhizoma or prostrate root-stake, with roots and leaves. (*b*) Base of flowering culm. (*c*) Flower separated, with its scaly perianth. (*d*) Ovary. A 2. *Acorus gramineus*. (*a*) Culm. (*b*) Leaf-like spatha. (*c*) Flowers congested on a spadix. B. Part of spadix magnified. (*a*) Stalk. (*b*) Base of spatha. (*c*) Spadix set round with flowers. C. Single flower isolated. (*a, a, a*) The sepals of the glumaceous perianth. (*b, b*) Stamina. (*c*) Stigma. (*d*) Ovary. D. Stamen, with the anther dehiscing. E. Ovary cut transversely. F. A seed. (*a*) The hilum. G. Vertical section of the fruit, shewing (*a, b*) fertile seeds. (*c*) Abortive ovule. H. Seed detached. (*a*) The fertile, (*b*) the abortive ovules. I. Section of the seed. (*a*) The seed coverings. (*b*) The albumen. (*c*) The embryo.

other *Acorinæ*, in which the united flowers are surrounded by a scaly perianth, form the type Orontiaceæ.

(1118.) *Orontium*, which denominates the type, is a name supposed to have formerly belonged to some plant, at present unknown, that grew abundantly on the banks of the Orontes. It is now applied generically to distinguish several exotic species, among which is the Tawkee (*O. japonicum*), the seeds of which Kalm states that the Indians eat when boiled as we do peas. Cattle are fond of the leaves of these plants, which grow abundantly in swamps and wet low grounds.

(1119.) *Dracontium fœtidum*, which possesses the odour and some of the properties of assafœtida, is said to be useful in cases of asthma. *D. pertusum* is a drastic purgative administered with advantage in some cases of dropsy; but, if taken in too large doses, it produces *risus sardonicus*, and other untoward effects.

(1120.) *Acorus Calamus* (the sweet smelling flag-rush), is our only indigenous plant which is at the same time both aromatic and bitter. It contains a considerable quantity of essential oil, that imparts the delightful fragrance for which it is peculiar, to the farinaceous substance abounding in its enlarged rhizoma. It is consumed in great quantities by perfumers and the makers of hair-powder. Indeed, in the neighbourhood of London, it has been almost wholly destroyed by their continual maraudings.

The root-stake of this plant affords a very agreeable tonic. In Constantinople it is made into a confection, which is considered a good stomachic, and it is eaten freely during the prevalence of epidemic diseases. In cases of chronic catarrh and humoral asthma, much benefit has been received from its exhibition.

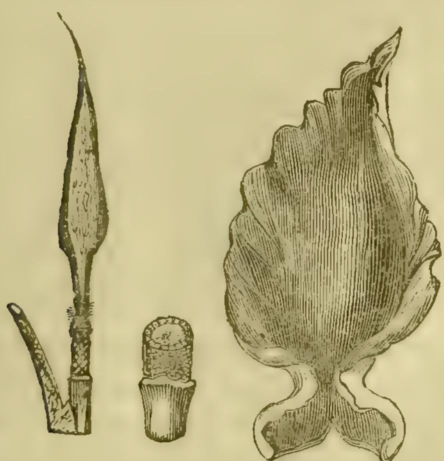
(1121.) Callaceæ. *Arum*, *Calla*, *Caladium*, and the other acorinæ in which the flowers are achlamydeous and fruit fleshy, form the type Callaceæ: the *Aroideæ veræ* of Brown and Richard. Besides the above differential characters, these plants have pinnatifid or pedatinerved leaves, the veins not being parallel and linear, as is usual in the order to which they belong, but divided, and apparently interlaced, as in the foliar expansions of some frondose ferns; and simulating the manner in which the veins are reticulated in several groups hereafter to be described. The spathæ in this type are greatly developed, and the flower-stalk or common receptacle, is often continued beyond the insertion of the flowers, in the form of a succulent spadix.

(1122.) All these plants contain an acrid principle, which renders many of them highly poisonous. It is, however, most powerful in their fresh state, and may be removed by drying or boiling. Hence the roots of the common *wake-robin*, which are grumous and full of farina, although acrid when fresh, are manufactured into a bland and very nutritious food, sold in this town under the name of Portland sago; being so called from the Island of Port-

land, where the plant grows in abundance, and the manufacture is principally carried on. The roots of several of the *Caladia* are similarly used, although their sap is in general acrid, and that of *Caladium seguinum* so venomous, that, when a small piece of the plant is chewed, it paralyzes the muscles of the mouth and fauces, causes the tongue to swell, and deprives the sufferer of the faculty of speech; the sap of *Caladium arborescens*, although less powerful, is still so caustic, that occasionally (says Merat) the lips of the negroes are wetted with it, as a punishment for slight misdemeanours.

(1123.) *C. sagittæfolium*, the Brazil cabbage, is eaten when boiled instead of coleworts; the roots are less esteemed than the foliage, and the leaves are often used instead of plates and dishes.

Arum Dracunculus is a very remarkable and strange looking



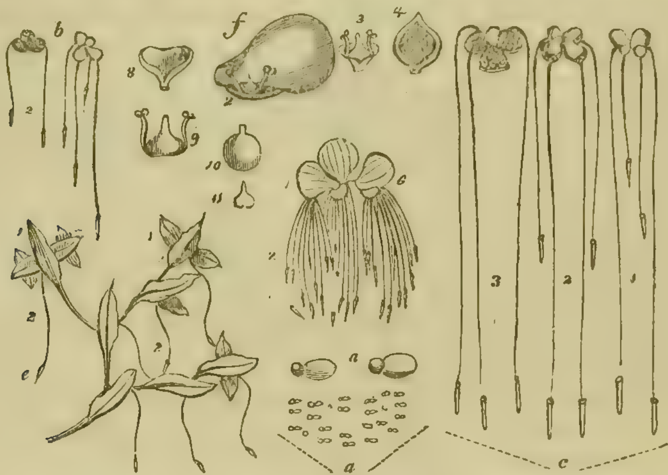
Arum dracunculus (the dragon arum), shewing the open spatha and spadix, with stamineous and pistilline flowers, whorled nectaries, and crowded ovaria.

plant, the stem being spotted with purple and brown like the belly of a snake, and the lurid spatha and spadix stinking like carrion; the root is said to possess emetic powers. Arum colocasia is a common dietetic plant in Egypt and the Levant, both leaves and roots being eaten when boiled.

Caladium esculentum is also important as affording nourishment to many nations. Its roots, or rather rhizomata, are of great size and replete with starch; which, in the Canary Isles, in Brazil, and many other places, becomes one of the staple means of sustenance.

(1124.) LEMNACEÆ. By *Lemna* (the water-lens or duck-meat), a connection is formed between the two previous types and several of the lower orders; for in *Lemna* the organization of flowering plants seems reduced to its simplest state, and indeed, in some species, propagation goes on indefinitely by buds, the flowers

having never been detected. Here neither leaf nor stem is formed distinctly, but the caudex becomes succulent and leaf-like, and



(*a*, *a*) *Lemna arhiza*, variety of (*b*) *Lemna minor*. (1) The cellular cryptophyllous stem. (2) The spongioles on the filamentary roots. (*c*) *Lemna gibba*, in a gemmiparous condition. (*d*) *Lemna polyrhiza*. (1) Stem, with latent foliage. (2) The numerous roots, with their spongioles. (*e*) *Lemna trisulca*. (1) Lobed subfoliaceous stems. (2) Radicles. (*f*) Parts of fructification. (1) Spatha with (2) flower, consisting of two stamens and one pistil destitute of perianth. (3, 4) Flower separated, shewing the same parts with the spatha (8) Spatha. (9) Flower without the spatha. (10) Seed. (11) Cleft embryo.

from its side proceed two naked stamens, generally accompanied with a single pistil, which constitute the flower. These plants are often unattached, and float about in the water at the mercy of the wind and waves; in them no spiral vessels have been as yet discovered; still the evolution of stamina and pistils associate them with the non-petaloid *palmares*, and their general structure with arum, of which some acute physiologists have well observed, they seem to be representatives reduced to the simplest form. From *Lemna*, the normal genus, this type has been called by De Candolle *Lemnaceæ*, which term is preferable to Pistiaceæ, proposed by Brown, for the latter word too much resembles in sound Pistacia, *Pistaciæ*, *Pistaciaceæ*, names already appropriated to very different plants.

(1125.) In the Lemnaceæ the fruit is dry, capsular, and indehiscent, the general axis abortive, and the stem and foliage united and undistinguishable from each other.

(1126.) Of the properties of these plants not very much is with certainty known. *Pistia stratiotes*, which is the Lemna of warm countries, like our Lemnæ, is often flowerless even in the Nile; and then still more strongly than usual reminds the botanist of Salvinia, of which it would seem to be a flowering

ally. It is said to be acrid, and when growing abundantly, as it often does in the tanks of the tropics, to render the water unwholesome, causing hæmorrhages from the bowels, if freely drunk. The Lemnæ are, however, harmless plants, which increase during warm weather with most astonishing rapidity. They are nutritious, and being a favorite food of water-fowl, are called duck-meat.

(1127.) *Arum,* and especially Calla, give excellent illustrations of the change or metamorphosis of the foliage into the more showy parts of flowers, for in Arum the inner surface of the enlarged bracte or spatha becomes variously coloured, and in Calla it gradually changes from green to a snowy white. Lemna likewise, by the union of stem and leaves, and the abortion of general axis, still further demonstrates the primitive identity of all these parts.

Several anomalous evolutions are observable in the plants included in this section, for not only are the tubular vessels occasionally obsolete, but the albumen is absent from some of the *Callaceæ,* as in *Dracontia fœtidum,* and *polyphyllum;* and in *Caladium* the embryo has no distinct cotyledon; it exhibits several germinating points, and is internally of a uniform structure resembling a spore; the leaves are also, in Callaceæ, subreticulated; and the stem and foliage in the Lemnaceæ undistinguishable.

NAYADINÆ.

(1128.) This section, which includes the exalbuminous Juncales, exhibits several strong points of resemblance to the preceding, the *Acorinæ*, and not a few to the succeeding, the *Juncinæ*, as well as to the *Alisminæ* of the order Liliales, and even to the Algæ. Their affinities are also not only many, but strong, for in each of the above-named groups some of the genera have been occasionally placed. To the *Acorinæ* they are allied by a similar gradation with them, from naked separate, or united flowers, with spadiciform inflorescence, to spathes and scaly perianths; and from them they are chiefly distinguished by their habit and exalbuminous seeds; for the latter of which the occasional absence of albumen in the *Dracontia* prepares the way, and corroborates the link. Their exalbuminous seeds also distinguish them from the *Lemnaceæ*, with which one type is closely associated in habit, and by its simply cellular structure; and the same character separates them from the *Juncinæ* to which the *Juncaginaceæ* form a transition; while their achlamydeous flowers or glumaceous perianth will distinguish them from the *Alisminæ*, to which by some writers they have been joined, on account of their exalbuminous seeds.

(1129.) Nayadaceæ. The grass-wreck (*Zostera*), and the river-guest (*Potamogeton*), with *Caulinia*, *Nayas*, *Zannichellia*, and other achlamydeous, exalbuminous *Juncales*, with separated flowers, one-seeded carpels, and intrafoliaceous vaginæ, form

collectively, a well-marked but not a very interesting type, called, from *Nayas*, a genus which, by its name, well indicates their habits, the NAYADACEÆ. They have also at various times been denominated

A. *Zostera marina.* (*a*) Foliage. (*b*) Spadices of flowers. (*c*) Pistil separated. B. *Zannichellia palustris.* (*a*) Foliage. (*b*) Fruit. C. Ditto, enlarged. (*a*) Naked stamineous flower. (*b*) Pistilline one.

Hydrogetons, *Potameæ*, *Fluviales*, and *Potamophileæ;* all terms having a similar reference to the places in which they are found.

Like the *Lemnaceæ*, these plants are believed to be destitute of spiral vessels, or, if not wholly absent, they are nearly obsolete: in *Caulinia*, Amici says no trace of them can be found. Their cellular structure likewise remains uncondensed in its outer layers; therefore no cuticular integument is formed, and they are devoid of stomata. Hence both these types descend in structure nearly to the rudimental state of the Algæ, from which, however, they are distinguished by their flowers, when other diagnostics fail.

(1130.) None of the Nayadaceæ are known to be possessed of any very active properties, and one only is much used by man, viz. the *Zostera marina*, which forms an excellent packing for brittle ware: this (the grass-wrack of mariners) is also platted into coverings for bottles and oil-flasks; and lately, under the name of *Alga marina*, it has been recommended as stuffing for mattresses, being tolerably light and soft, and intolerant of vermin; a great recommendation in many places.

The roots of *Aponogeton distachyum* are fed on by the Hottentots; and those of *Potamogeton natans* are sometimes eaten in the wilds of Siberia by men, but in more temperate regions they are fed on only by swans, who devour them with avidity. Ducks feed on the seeds and leaves of *P. crispus*, *P. densus*, and several other species; but these plants are more important from their functions of elaborating oxygen, and rendering water respirable for fish and other aquatic animals, than from the quantity of food that they afford; which is, however, by no means inconsiderable to the humbler tribes. Haller says, that *Potamogeton serratum* grows in the Swiss lakes to the enormous length of from ten to twenty fathoms, forming as it were extensive subaquatic forests in those vast natural reservoirs.

(1131.) PODOSTEMACEÆ. *Podostemon*, *Lacis*, *Marathrum*, and *Mniopsis*, plants very little known, constitute a type called the *Podostemaceæ* or *Podostemeæ*, which is distinguished from Nayadaceæ by having united flowers and many-seeded carpels.

(1132.) They are chiefly interesting as being the transitional series from the *Fluviales* or *Nayadaceæ* to the following group. To the *Nayadaceæ* and *Acorinæ* they are connected by the absence of calyx and corolla, and by the presence of a spatha, the structure of which allies them also with *Lemnaceæ;* but in *Podostemaceæ* the seeds are numerous, while in *Lemnaceæ* they are few. Martius observes the resemblance which the first two genera have in their habit and mode of flowering to *Jungermanniæ*, as if they were noble monocotyledonous liverworts. These plants are aquatics, with their foliage developed rather in leaf-stalks (*phyllodia*) than forming true leaves. The perianth is absent; stamens hypogynous, definite, some sterile; fruit capsular; seeds exalbuminous and many: all of which characters associate them with Nayadaceæ, of which they might, almost with propriety, be considered a subtype, notwithstanding the opinion which has been adventured, that they are dicotyledons, and allied to the peppers; which, however, in turn, have been stated to be monocotyledonous plants, although the structure of their stem, and the venation of their leaves, are decidedly exogenous.

(1133.) JUNCAGINACEÆ. *Trigochlin*, *Scheuchzeria*, and other achlamydeous or glumaceous plants, with hexandrous united flowers, dry fruit, erect seeds, and straight cleft embryo, form a type, which, from their rush-like habits, has been called *Juncaginaceæ;* the old name for *Triglochin* being *Juncago*.

(1134.) The *Juncaginaceæ* are plants that delight in bogs, marshes, and other wet situations, but have not the floating habits of the *Podostemaceæ* and *Nayadaceæ*, but rather that of rushes,

to which they are closely associated by *Scheuchzeria*. Their ex-albuminous seeds, however, easily distinguish them from the *Junicinæ;* and their glumaceous perianth, or naked flowers, from the *Alisminæ*, to which they are joined by Richard and Bartling. *Lilæa*, which is achlamydeous, connects them with the *Podostemaceæ*, as *Scheuchzeria* does with the *Juncaceæ;* and, should it cease to be a solitary exception, it may form the normal genus of a subtype: at present, however, further analysis is unnecessary.

(1135.) These plants are all innoxious, but none of them have been applied to any useful purpose: they contain very little nutritious matter, and form poor fodder, which but few animals will eat.

JUNCINÆ.

(1136.) The true rushes (*Junci*), and the cord-rushes (*Restiones*), are the normal genera of the two types, Restiaceæ and Juncaceæ, included in the section Juncinæ. The latter type approaches very closely to the Liliales, while the latter associates them with the sedges. They are glumaceous (rarely achlamydeous) Juncales, with large albumen, small embryo, and central placentæ.

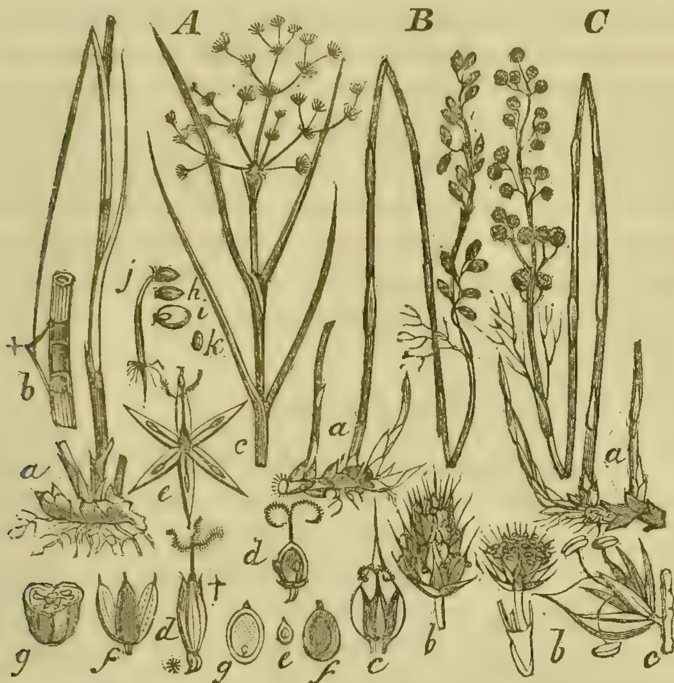
(1137.) Restiaceæ. The genera which this type comprehends, although agreeing in the more important characters, differ in so far in minor particulars, that it is necessarily divided into three subtypes, called, from Centrolepis, Restio, and Eriocaulon, the *Centrolepidæ*, *Restionidæ*, and *Eriocaulidæ*. The first named is distinguished by having achlamydeous, monandrous flowers, with simple anthers, and numerous discrete carpella. The second, by its sepaloid perianth, simple unilocular anthers, and three or two celled capsular or drupaceous fruit. The third, by its sepaloid perianth, two-celled anthers, and three or two celled capsular pericarp.

(1138.) Collectively, the type is known from the Juncaceæ by the embryo being lenticular, outside the albumen, and remote from the hilum.

(1139.) Juncaceæ. *Juncus*, *Luzula*, and their allies, which form the type Juncaceæ, are distinguished from the preceding group by the embryo being always next to the hilum, and included within the albumen. The testa of the seed is also pale and soft, and the placentæ central.

(1140.) The Juncaceæ are generally herbaceous plants, rarely suffruticose; the rhizomata are scaly, with long subterranean di-

visions. Hence they are often planted to corroborate sea and river walls, and various embankments, as may be seen on our own coasts, but more especially on those of Holland, where the *J.*



A. *Juncus articulatus.* (*a*) Creeping or burrowing rhizoma, with culm and leaves. (*b*) Section of one of the cylindrical leaves, shewing their pithy diaphragmata. (*c*) Upper part of culm, with its panicle of flowers. (*d*) A flower magnified. † The glumaceous perianth. * The bracte turned down. (*e*) A flower opened, shewing the hexasepalous perianth, stamens, and pistil. (*f*) The capsule dehiscing, and shewing the central placenta. (*g*) Horizontal section. (*h*) The seed. (*i*) Longitudinal section, to shew the embryo included within the albumen, and near the hilum.

B. *Restio tetraphyllus.* (*a*) Entire plant, reduced. (*b*) Head of fertile flowers. (*c*) A fertile flower, isolated, with its bracte. (*d*) Perfect pistil, with two rudimentary stamens. (*e*) Fruit, natural size. (*f*) Ditto magnified. (*g*) Vertical section of pericarp, to shew the embryo remote from the hilum, and outside of the albumen.

C. *Restio tetraphyllus.* (*a*) Barren or stamineous plant. (*b*) Stamineous flowers in a capitulum. (*c*) One separated to shew the well-developed stamens.

acutus and *J. maritimus* vie with the mat-grasses and sand-sedges in protecting the low lands from the encroachments of the sea, by the strength their long interlacing roots give to the soil. The Juncinæ are none of them poisonous plants, but they are now applied to few domestic purposes, save the making mats, baskets, chair-bottoms, and brooms; their chief occupation being gone, since the advance of luxury has spread the apartments of our citizens with carpets, although, as late as the time of the last

Henry, the king's chamber was only strewed with rushes, and one of the charges against Cardinal Wolsey for extravagance was having his room restrewed so often as once a-week. Some of the Restiaceæ are used as thatching; and both them and the Junceæ, instead of twine: they are also twisted as substitutes for ropes; whence indeed sailors call cables *junks*, as *Juncus* itself is a derivative of *jungo*, to tie together or join.

In the Junci, the medullöid cellular structure, abundant in many of the palms, assumes still more the form of pith, and gives them in this respect somewhat the aspect of exogenous plants. "This pith is in great request to form the wicks for certain candles, which are hence called rushlights."

LILIALES.

(1141.) Lily (*Lilium*, λειριον, κρινον), probably derived from an Eastern word signifying a flower, or, as some affirm, from the Celtic *Li*, (whence the Gallic *Lis*,) *whiteness* or *shining*, is a name that has been given to many very different plants; such as the water-lily (Nymphæa), the superb lilies, now commonly so called, and others; even to the *Lilach* (Syringa), the original Persian name for which has been anglicised without alteration.

(1142.) The application of this term has been very variously extended and restrained; for the word *lily* has been used both as a general and an individual name. It was thus employed by the ancients, and also, among the moderns, both by Linnæus and Jussieu.

Solomon uses *lily* (Shushan) in a collective sense, and likewise distinguishes, among lilies, the Shushan of the valley; and "a Greater than Solomon," when he gave us the affectionate command to "consider the lilies of the field," seems, while adopting popular language, evidently to have had a similar comprehensive meaning, which may be shewn, both from the context and from modern phyto-geographical researches. Historical references, and a knowledge of local peculiarities, can alone fully develop the impressive beauty of this, as well as of many other passages in ancient records. Thus, for example, it is well known that fuel is so scarce in the Holy Land, and in many parts of the East, that the inhabitants regard large trees with especial reverence, and are obliged to use by turns every kind of combustible matter, such as the withered stalks of herbs and flowers, the tendrils of the vine, the small branches of rosemary, and other plants, to heat their baths and ovens. Allusion to this custom is easily recognized in this passage, and adds much natural force to Christ's concluding remark: "If God so clothe the grass of the field, which to-day is, and to-morrow is cast into the oven, shall he not much more clothe you, O ye of little faith?" The *grass* of the field

here evidently includes the lilies, of which the Saviour had just been speaking, and by consequence such herbaceous plants in general; and in such an extensive sense both words are not unfrequently to be taken. This will appear still further evident from the observations of Sir James E. Smith, who, when endeavouring to identify these lilies, which he considers not to have been *lilies* but *amaryllides*, says, "It is natural to presume, the divine Teacher, according to his usual custom, called the attention of his hearers to some object at hand, and, as the fields of the Levant are overrun with the *Amaryllis lutea*, whose golden liliaceous flowers afford in autumn one of the most brilliant and gorgeous sights in nature, the expression of 'Solomon in all his glory not being arrayed like one of these,' is peculiarly appropriate. I consider the feeling," he continues, "with which this was expressed as the highest honour ever done to the study of plants; and, if my botanical conjecture be correct, we learn a chronological fact respecting the season of the year when the sermon on the Mount was delivered." The white lily and the chalcedonian are, however, both Levantine plants; and many other lilies are natives of, and so abundant in the East, that a Persian province was called Susiana, and its chief city Sushan, from these beautiful flowers growing there naturally in excess. Hence, although the Amaryllis can by no means be excluded, the other Liliaceæ should be included likewise.

(1143.) Pliny ranked the lily next in excellency to the rose, and it is doubtful whether in external beauty it does not exceed it. Anacreon, in his odes, compares Venus to this flower; but perhaps with less than his usual felicity, as it has always been regarded as the emblem of purity and moral worth.

(1144.) Linnæus seems to have included in his general group Lilia all those liliaceous plants which form his natural orders *Sarmentaceæ*, *Scitamineæ*, *Orchideæ*, *Ensatæ*, and *Tripetalöideæ*, as well as his *Coronariæ* and *Spathaceæ*, or LILIES *without*, and LILIES *with Spathæ*. And Jussieu, although nominally reducing the Lilia to much narrower bounds, still indicates, by their relative position, their affinity to the subordinately distinguished groups.

(1145.) The peculiar advantages of these and other similar schemes of systematic arrangement are, on the one hand, accurate analysis; on the other, comprehensive synthesis; and, although not usually regarded as consentaneous, they are certainly not incompatible with each other. Therefore, while the modern natural subordinate groups of De Candolle, Brown, and others, are retained and distinguished by the ending of their names in *aceæ*, and the intermediate sections, which are nearly equivalent to the orders of Jussieu, are characterised by the suffix *inæ*, the larger collective orders of Linnæus have been preserved, but at the same time reformed; and are here known, as the major groups in the previous classes, by the termination of their names in *ales*. For *Lilia* in this, as well as Musæ, Pini, Zamiæ, Junci, and Rosæ in other orders, is inadmissible as a common collective term, from its being

like them only in the plural form of the generic name of the various normal species.

(1146.) The Liliales, differentially considered, are *Palmares*, or non-glumose monocotyledons, with superior (very rarely inferior) ovaries, ovules marginal, leaves undivided, seldom rigid, and perianth petaloid, often distinguishable into calyx and corolla.

(1147.) The several types included in the order Liliales are associable into three well-marked sections, which, from the normal genera, *Commelina, Alisma,* and *Lilium,* are called the *Liliacinæ, Alisminæ,* and *Commelineæ,* or *Ephemerinæ:* the first named comprehending the hexapetalous albuminous types; the second, those which are exalbuminous; and the third, all the tripetalous ones with albuminous seeds.

A. *Pontederia cordata.* (*a*, *b*) Cuttings, with leaves and flowers. (*c*) A flower opened, to shew the union of its six pieces, and the irregular disposition of the stamens. (*d*) A stamen detached. (*e*) The pistil separate, to shew the superior germen. (*f*) A transverse section of the ovary.

B. *Tradescantia virginica.* (*a*) A cutting, with leaves and flowers, shewing the tripetalous corolla. (*b*) A flower separate, to shew the trisepalouscalyx, (the inner whorl of the perianth being removed,) and the stamens and pistil. (*c*) A stamen detached, to shew the hairy filaments. (*d*) An enlarged view of one of the hairs, to shew its cellular structure. (*e*) The pistil denuded, to shew the superior germen, (*f*) the fruit, with the persistent calyx. (*g*) Transverse section of the trilocular capsule.

EPHEMERINÆ.

(1148.) Three small groups, which have been at different times more or less closely combined with the *Junci*, but which are rather transitional between the Juncaceæ and the hexapetalöid Liliales, than truly rushes, form the section EPHEMERINÆ, so named from the ephemeral duration of the blossoms of the principal genera: they have been also called *Commelineæ*, from Commelina, a genus commemorative of two Dutch botanists, John and Gaspar Commelin.

(1149.) The Ephemerinæ are tripetaloid Liliales, with superior ovaries, and albuminous seeds, with the embryo included within the albumen. The three associated types are named *Aphyllanthaceæ*, *Xyridaceæ*, and *Ephemeraceæ*.

(1150.) APHYLLANTHACEÆ. *Aphyllanthus*, *Dasypogon*, and *Callectasia*, are usually arranged with the rushes, forming only a subtype of the Juncaceæ, called *Aphyllantheæ*; but the true rushes seem to form a more natural group when they are excluded; and their connexion with the Juncaceæ is indicated even when they are distinguished as a separate type, transitional between the Juncinæ and Ephemerinæ.

(1151). The Aphyllanthaceæ are known by their tripetaloid perianth, central placentæ, seeds with soft pale testæ, and embryo included within the albumen.

(1152.) XYRIDACEÆ. This type was formerly a subsection of

Xyris operculata.

(*a*) A capitulum of flowers.

(*b*) A scale or bractea.

(*c*) The calycine pieces of the perianth.

(*d*) The corollaceous whorl, with the three stamina, three nectaries, and pistil.

(*e*) The fruit in an early state.

(*f*) Ditto, mature.

(*g*) The lower part of the pericarp.

(*h*) The operculum, or upper portion.

(*i*, *j*) Seeds enlarged.

the cord-rushes, but is well distinguished from them by the highly developed internal perigone or corolla. It connects this section with the *Ephemeraceæ*, or fading lilies, called likewise, from *Commelina*, the Commelinaceæ, but for which Batsch's synonyme, indicative of the delicate and perishable character of the blossoms, perhaps is preferable.

(1153.) The Xyridaceæ are tripetaloid *Ephemerinæ*, with concrete carpella, unilocular three-valved capsule, parietal placentæ, and included (?) embryo.

(1154.) Ephemeraceæ. The genera *Commelina*, and *Tradescantia*, [1147, b,] associate to form this type, in which the capsular fruit is two or three-celled, the placentæ central, and the trochlear embryo included within the albumen and remote from the hilum.

(1155.) The Commelinæ are ornamental plants, some of them commonly cultivated. None of them are deleterious, but not any are here employed either as food or medicine, although in America and in Cochin-china several species, as C. communis and C. medica, are esteemed sedative and expectorant; and the tubercles of C. tuberosa, which are sweet and savory, are eaten by the Chinese.

(1156.) So different in appearance are the delicate petaloid teguments of these plants from the husky perianths of the ordinary rushes, that their affinity might well be doubted by the common observer, did not aphyllanthes, usually placed among the rushes, with its pretty flowers, clearly indicate the connexion, which is still further substantiated by Philydrum, that seems to be a reduced Commeline, the petaloid perianth being only two-leaved, and the flowers monandrous, the two lateral filaments being barren. Dr. Brown has hence proposed to make this osculant genus typical of a subordinate group, which will again associate the *Ephemeraceæ* and the rushes, and to call it *Philydreæ*, or rather *Philydridæ*; it is readily distinguished by the diphyllous perianth.

ALISMINÆ.

(1157.) This section includes all the exalbuminous Liliales. The genera are associated in two types, named the Alismaceæ and Butomaceæ, which are often arranged with the *Juncagineæ*, on account of their seeds being destitute of albumen, but from which they are easily distinguished by their corollaceous perianth and uncleft embryo. This section appears to be

transitional from the tripetaloid to the hexapetaloid liliales, and again, to connect both with the JUNCALES.

A. *Alisma plantago.* (*a*) Upper part of the flowering stem. (*b*) Radical leaf. (*c*) A flower separate, natural size. (*d*) Pistils. (*e*) Stamen magnified. (*f*) Fruit. (*g*) One capsule, separate. (*h*) Ditto, cut transversely, to shew the seed, consisting of a curved embryo with albumen. (*i*) The seed removed from the pericarp. (*k*) The embryo without the cotyledon. (*l*) A seed germinating. (*m*) A section of a young plant, to shew the plumula (*n*.)

B. *Butomus umbellatus.* (*a*) Phylloidaceous leaves. (*b*) Umbel of flowers. (*c*) One flower separate. (*d*) Pistils. (*e*) Carpels. (*) Horizontal section of the fruit. (*g*) A capsule separated. (*h*) Seed enlarged. (*i*) Longitudinal section of the same. (*k*) A seed beginning to germinate. (*l*) Ditto, more advanced. (*m*) Section of a leaf, to shew its angularity.

(1158.) ALISMACEÆ. The water-plantain (Alisma), the star-fruit (Actinocarpus), the arrow-head (Sagittaria), and other exalbuminous Liliales, with superior ovaries and few-seeded indehiscent fruit, are associated to form a type, called, from the normal genus, the Alismaceæ.

(1159.) They are water-plants often floating with lax stems on the surface, the rhizomata frequently large and fleshy, stem contracted, leaves radical, entire, with linear veins, and broad expansions. The flowers are either separate or united, the outer whorl of the perianth decidedly sepaloid, the inner corollaceous; the

numerous distinct carpels are dry and indehiscent, the seeds, one or two in each carpel, exalbuminous, and the embryo often curved.

(1160.) The Alisma Plantago has long enjoyed a not unquestioned reputation for its specific influence in the treatment of canine madness. Several cases have been published by Lewshin, Burdach, Moser, and others, in which it is asserted to have worked well-marked cures. Its root was administered in doses of two drachms and a half daily, and the leaves made into a poultice and applied to the wound. But, notwithstanding these assurances, it is probable that the escape of the patients alluded to should be rather attributed to the well known casualty of the hydrophobic poison having been never introduced, than to the antilyssic virtues of Alisma. The powdered roots have been substituted for uva ursa with advantage in cases of irritable bladder, in doses of a drachm.

(1161.) The tubers of this plant, as well as those of other the genera and species, such as Sagittaria, contain a good deal of amylaceous matter, and form a nutritious food. They are commonly eaten by the Kalmuc Tartars.

(1162.) Butomaceæ. The flowering rush (*Butomus*), with its allies, *Hydrocleis* and *Limnocharis*, are distinguished as a type by the floral envelopes being still more petaloid than in the Alismaceæ; for in these the whole six pieces are more or less coloured. Besides the common characters of the section, they are well distinguished as a type by the rare occurrence of the vessels that nourish the erect seeds (and which are called the placenta or trophosperm,) being branched and spread in a reticulated manner over the sides of the one-celled three-valved many-seeded capsule. This structure is found in no other monocotyledons.

(1163.) This group, which is named from *Butomus*, the *Butomaceæ*, shows an affinity, by its highly developed and much coloured perianth, to future sections, in which the whole of the pieces are still more decidedly petaloid.

(1164.) The *Butomaceæ*, like the Alismaceæ, have a contracted general axis, and radical foliage and flower-stalks. The leaves, however, are unexpanded, and resemble phyllodia, linear, entire, and often sharp at their edges, and, from their cutting or injuring the mouths of cattle, the genus *Butomus* has received its name. Butomus umbellatus is one of the most beautiful British plants; its leaves are acrid, and are sometimes used as a purgative. Its

seeds and roots are recommended as antidotes to the bites of serpents.

(1165.) The sap in Limnocharis is milk-like, which is a rare occurrence in plants of this class; indeed, De Candolle says that no endogenæ are lactescent; the above is, however, an exception to the general rule.

LILIACINÆ.

(1166.) This section contains all the hexapetaloid *Liliales* with albuminous seeds. The perianth in these plants is for the most part regular, and altogether corollaceous, but more or less eminently developed in the several grades; the ovaries are superior, (very rarely inferior,) and the axile embryo lodged in a cavity of the albumen.

(1167.) The genera, which agree in the comprehensive characters of the section, are associated in five subsectional groups or types, in which the evolution of the perianth is gradually carried to its

A. Yucca Aloifolia. (*a*) Crown of foliage. (*b*) Inflorescence. B. Single flower of Yucca, to shew the highly developed perianth and superior germen. C. Aloe vulgaris. (*a*) Stem. (*b*) Rigid, fleshy leaves. (*c*) Flower-stalk. D. Spike of flowers. E. A flower separated. (*a*) The perianth. (*b*) The stamens. (*c*) The pistil. F. The stamens denuded of the perianth. G. Hemerocallis fulva.

acme of splendour, and again gradually wanes in beauty towards the tripetaloid groups of the succeeding order. From the normal genera *Pontederia*, *Asphodelus*, *Lilium*, *Colchicum*, and *Smilax*,

the types have been named the PONTEDERIACEÆ, ASPHODELACEÆ, LILIACEÆ, COLCHICACEÆ, and SMILACEÆ. This manifold distribution is required not only by the number of the genera comprehended in the section, but also by the essentially different habits and structural peculiarities of the groups themselves; but as the systematic distinctions are not very marked, perhaps the differential characters will appear in stronger relief by being collected and contrasted in immediate succession, than if distant references be made from one to the other in the course of the work alone.

(1168.) The PONTEDERIACEÆ have unequal stamens, and an irregular perianth, tubular at the base with a circinnate æstivation, and the segments are involute after flowering.

(1169.) The ASPHODELACEÆ have hexandrous (or by abortion triandrous) flowers, with introrse anthers; the perianth small, either regular or irregular; and the seeds with a black, brittle, crustaceous testa.

(1170.) The LILIACEÆ have hexandrous flowers, the perianth large and highly developed, the anthers introrse, the styles connate, and the seeds with a soft and spongy testa.

(1171.) The COLCHICACEÆ have hexandrous flowers with extrorse anthers, trifid, tripartite, or distinct styles, and occasionally inferior germen.

(1172.) The SMILACEÆ have united flowers, introrse anthers, fruit baccate or capsular, and seeds with a membranous testa.

(1173.) The DIOSCORACEÆ, which are often associated with the *Smilaceæ*, seem rather, by their constantly inferior ovaries, to be systematically allied to the *Musales*, between which and the present order they form the link of communication.

(1174.) PONTEDERIACEÆ. *Pontederia* [§ 1147, fig. A,] and *Heterantha* compose this small type, which is the osculant group between the *Ephemerinæ* and *Asphodelaceæ* of the *Liliacinæ*: it differs from the *Ephemeraceæ*, with which it formerly was blended, not only in the development of the perianth, but also in having the embryo axile, or in the same direction with the seed, it being the reverse in them, as well as in having a punctiform hilum, while in *Ephemeraceæ* the hilum is large, and occupies the entire side of the seed. Their differential characters have been already given, [§ 1170.]

(1175.) The Pontederiaceæ are aquatic plants, natives of the East Indies, Tropical Africa, and North and South America: they

are ornamental, and may easily be cultivated in an aquarium; their properties are unknown, and they have not hitherto been applied to any useful purpose.

(1176.) ASPHODELACEÆ. The genera Asphodelus, Aloe, Allium, Asparagus, Dracæna, Gilliesia, Hyacinthus, Scilla, and others, have been separated from the once unwieldy and heterogeneous assemblage, called by the older botanists *Liliaceæ*, and are associated to form the present type, by the characters already given in § 1169. They are evidently intermediate between the PONTEDERIACEÆ and LILIACEÆ, and their connexion is also strong with the JUNCACEÆ through *Aphyllanthes.* From all these orders they are however separated by the peculiar black, brittle, crustaceous testa of their seeds, as well as by the degree of development of their perianthium, which, although petaloid, and often beautifully so, is far less evolved and conspicuous than in the *Liliaceæ*, while in the *Juncaceæ* it is glumaceous.

(1177.) The *Asphodelaceæ* vary much in their size, some being small herbaceous plants, while others are arboreous in their port; their roots are fibrous, fascicled, or bulbiferous; leaves with parallel veins, and often grass-like; flowers united; perianth either regular or irregular; ovarium superior, three-celled; style single; stigma entire; capsule mostly three-celled, three-valved, with loculicidal dehiscence; seeds varying in number, with black, brittle, crustaceous testa; embryo included within the albumen.

(1178.) The genera contained in this type differ in having some an irregular depauperated perianth, while in others it is regular and well developed. Two subtypes are hence distinguished, the *Gillesidæ* and *Asphodelidæ*, the former being the *Gillesieæ* of Lindley, the latter the true *Asphodeleæ.*

(1179.) *Gillesidæ. Gillesia* and *Mersia*, Chilian plants, with small inconspicuous irregular Liliacinous flowers, grass-like leaves, and tunicated bulbs, form this subtype, which, although differing in the above particulars from the *Asphodelidæ*, cannot well be separated from them, and are therefore here considered as a member of the common type. They are neither ornamental nor useful, although, from their structure, curiously interesting plants.

(1180.) It is doubtful whether the remaining *Asphodelaceæ* should be all retained in one subtype, or be further distributed. Could constant and obvious differential characters be discovered, it would be convenient to have the numerous genera here collected arranged in smaller groups, especially as some indications, although

at present faint, are naturally apparent; but, notwithstanding various attempts have been made, it must be confessed that they have not been hitherto successful. Dr. Brown's *Hemerocallideæ*, sometimes placed in *Asphodelaceæ*, as by Bartling, and at others in part combined with the *Liliaceæ*, as by Lindley, might with some modification be retained as an intermediate group, or as a subtype of the latter, the genera with crustaceous testæ being of course excluded.

(1181.) Until a more intimate acquaintance with the minor affinities of these plants shall lead to the discovery of more natural associations, the Asphodelaceæ with regular perianths may be arranged in two subtypes, called, from their respective normal genera, the *Aloidæ* and *Scillidæ*, the first including the arborescent or herbaceous genera, with fibrous or tuberous roots, and the latter those which are bulbiferous. Both these subtypes are distinguished from the *Gillesidæ*, not only by their regular perianth, which is more evolved and petaloid, but also by their seeds not having the crustaceous testa continued over the podosperm.

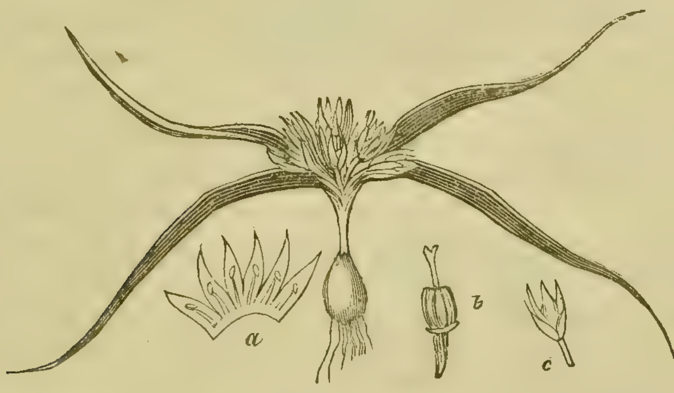
(1182.) *Scillidæ. Scilla*, *Hyacinthus*, *Allium*, and *Ornithogalum*, are among the most useful and ornamental plants included in this subtype.

(1183.) The species distributed among the genera *Ornithogalum*, *Scilla*, and *Hyacinthus*, are not very well defined, so that several have been successively referred to either group, of which *Hyacinthus non-scriptus*, or *Scilla natans*, and *Scilla maritima*, or *Ornithogalum squilla*, are familiar illustrations.

(1184.) Hyacinthus is a genus long celebrated, not only for the beautiful fable whence its name has been fancifully derived, but also for the immense number of varieties which culture has produced. Of the *H. orientalis*, the common species, the Haarlem florists had at one time upwards of two thousand varieties; these bulbs, as well as those of the Tulip and Narcissus, once formed a most valuable, and still a not unimportant, branch of Dutch commerce.

(1185.) The *Squill* (*Scilla maritima* or *Ornithogalum squilla*,) is a native of the southern parts of Europe, growing freely on the sandy shores of Spain, Italy, and Greece. It has long been celebrated for its medicinal virtues; it is extremely bitter, and is esteemed as an expectorant, nauseant, and diuretic. The bulbs often attain a large size, being sometimes as big as a man's head.

(1186.) The bulbs of these plants appear, as De Candolle observes, to contain two very different proximate principles, the one a



Allium chamæmoly. Entire plant, to shew the bulb and fibrous root. (*a*) The six-parted perianth with perigynous stamens. (*b*) The superior germen. (*c*) The spathiform bracteæ.

bland nutritious farina, which resembles that found in the tubers of the *Orchidaceæ*, and the other a bitter gum-resin, giving more or less acridity and power to the bulbs, according to its relative predominance. The *Scilla lilio-hyacinthus* is purgative and diuretic, as well as the *Ornithogalum squilla;* and the *Moly* of Homer, there is little doubt, was a species of *Allium*, the whole of which are diuretic, expectorant, and more or less acrid; indeed, the common generic name is said to be derived from the Celtic word, *all*, signifying *hot* or *burning*. The onion (*A. cepa*), leek (*A. porrum*), rocambole (*A. scorodoprasum*), garlick (*A. ampeloprasum*), shallot (*A. ascalonicum*), and chives (*A. schænoprasum*), all belong to this genus, and are more or less esteemed as condiments or food. They contain free phosphoric acid, whence their peculiar flavor. This acid is in a great measure dissipated by heat, so that onions, when boiled or roasted, become comparatively mild; and those grown in warm countries seem to be naturally less acrid than those which are cultivated here.

(1187.) Garlic, and onions of various kinds, were highly esteemed in Egypt, and, according to Haselquist, not without reason. He conjectures that the A. cepa, which is still used in that country in amazing quantities, and forms a most delicious food, is one of the species of onion after which the Israelites longed when in the wilderness. He says, "whoever has tasted onions in Egypt will allow that none can be had better in any part of the universe. Here they are sweet, in other countries they are nauseous and strong; here they are soft,

whereas, in the northern and other parts, they are hard, and their coats so compact that they are difficult of digestion. Hence they cannot in any place be eaten with less prejudice and more satisfaction than in Egypt."

It was probably an assumption of austerity and show of ascetic self-denial which caused the Egyptian priests to abstain from the use of onions as food, and this subsequently led to the superstitious reverence with which by the bulk of the people they were regarded.

> "Vilia Niliacis venerantur oluscula in hortis,
> Porrum et Cepa Deos imponere nubibus ausi."
>
> *Prud.* l. ii. *contr. Sym.*

Lucian, when giving an account of the different deities worshipped in Egypt, states that the inhabitants of 'Pelusium adore the onion,' πηλουσιωταις δε κρομμυον. The Egyptians indeed were commonly reproached for swearing by the leeks and onions in their gardens; for Pliny says, "Allium cepasque inter Deos in jure jurando habet Egyptus," an absurdity which did not escape the scourge of Juvenal, whose nation was, however, not less absurdly superstitious than that against which his satire was directed.

> "Quis nescit, Volusi Bythinice, qualia demens
> Ægyptus portenta colit.
> Porrum et cepa nefas violare aut frangere morsu;
> O sanctas gentes quibus hæc nascuntur in hortis
> Numina." *Sat.* xv.

> "How Egypt mad with superstition grown,
> Makes gods of monsters, but too well is known.
> 'Tis mortal sin an onion to devour;
> Each clove of garlic has a sacred power.
> Religious nation, sure, and bless'd abodes,
> Where every garden is o'er-run with gods!"

But while some of the people did not dare to eat leeks, garlic, or onions, for fear of injuring their gods, others fed on them with enthusiasm, excited by the zest of appetite, if not by religious zeal, if we may judge from the distich which declares that

> "Such savoury deities must sure be good
> Which serve at once for worship and for food."

(1188.) *Aloidæ*. *Asphodelus*, *Aloe*, *Phormium*, *Xanthorrhea*, and *Dracena*, with other non-bulbiferous *Asphodelaceæ*, form the subtype *Aloidæ*, or *Asphodelidæ*.

(1189.) The *Asphodels*, as the name (α σφαλλω) imports, were great favorites in ancient times. They were vaunted as not to be surpassed, and were sacred to Proserpine. The gold and silver Asphodels have long been common ornaments of our English gardens; the latter species covers immense tracts of land in

Apulia, and affords abundance of nutritious fodder for sheep. The tubers of several species abound in fecula, mixed with a bitter principle, which, although unpleasant when they are eaten raw, is wholly removed by boiling; and it is said that swine are so fond of the tubers that they will unearth the roots to devour them.

(1190.) *Aloe* is a very extensive genus, containing many highly ornamental plants, and including several which afford that most serviceable drug which bears their name.

The Aloes are herbaceous or suffruticose plants [§ 1167, fig. C, D], almost assuming an arborescent port, with succulent foliage, and often elegant flowers. The species named *spicata* and *Socotrina* afford the spiked and socotrine aloes; the former is cultivated extensively at the Cape of Good Hope, and such large quantities of it exported, that it has in a great measure driven the socotrine from the market. This latter is made in various islands in the Straits of Babelmandel, but, being originally brought from Zocotra, one name is given to the whole. The Barbadoes aloes, which is imported from Barbadoes and other parts of the West Indies, is made from several different species, especially the vulgaris, socotrina, and arborescens: it is in general a less pure and sightly drug than either the socotrine or the Cape: it is chiefly used by farriers, and hence is called Caballine aloes. (Vide Med. Bot.) In countries where the woody prickly species naturally abound they are planted as hedges, and their leaf-fibres, after the juice of the leaves has been expressed, are macerated and made into cordage and coarse cloths.

Aloe dichotoma is the arrow tree of the Cape, and is so called from the Hottentots converting it into weapons.

(1191.) *Phormium tenax*, the New Zealand flax, is the plant concerning which such sanguine hopes were once entertained that it would prove a more fertile source of flax than Linum. But although the fibres yielded by its leaves are abundant and of good quality, still practical difficulties have hitherto hindered its profitable culture both in Ireland and New Holland.

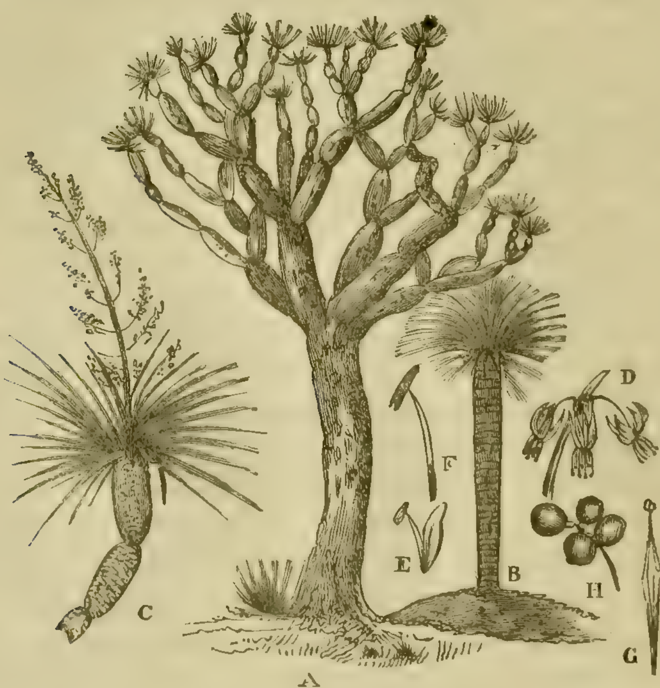
(1192.) *Xanthorrhea hastilis*, the grass-tree of New South Wales, has received its generic name from the yellow gum that flows from it copiously, and which is known in the markets as *gum acaroides*. The plant is an exceedingly curious one, and, from the bases of the leaves remaining attached in congested whorls around the stem, it shews some similitude to the palms.

(1193.) The *Dracenæ* assume an arborescent port, emulating palms in their columnar stems, and even exceeding them, if not in height, in age; they are natives of warm countries, being indigenous to China, the East Indies, the Sandwich Isles, the Mauritius, &c. In the Canaries these plants grow to an enormous size.

"The Dragon-tree (Dracæna draco) of Orotava, in the island of Teneriffe, is between fifty and sixty feet in height; its circumference near the roots is forty-five feet, and at ten feet from the ground its diameter is twelve feet. It had attained this gigantic size when the Spaniards first landed in the island, in the fifteenth century. The trunk is divided into a great number of branches, which rise in the form o a candelabrum, and terminate in tufts of leaves, like the Yucca of Mexico. At the time of Humboldt's visit it still retained sufficient vigour to produce both flowers and fruit annually; but in July, 1819, one half of its enormous crown fell. It is now a noble ruin; but the wound has been plastered up, and the date of the misfortune marked on it: and the great care taken of '*the venerable vegetable*' will probably ensure its surviving another century.' —*Humboldt's Personal Narrative*, vol. i. p. 142; *Researches*, vol. ii. p. 209; and *Graham's Voyage to Brazil*, p. 85.

The red sap of D. Draco, when inspissated, is known as one of the kinds of Dragon's blood. It is a styptic, but not much used. D. terminalis is planted as a land-mark in India and China, to divide

Dracæna Draco.

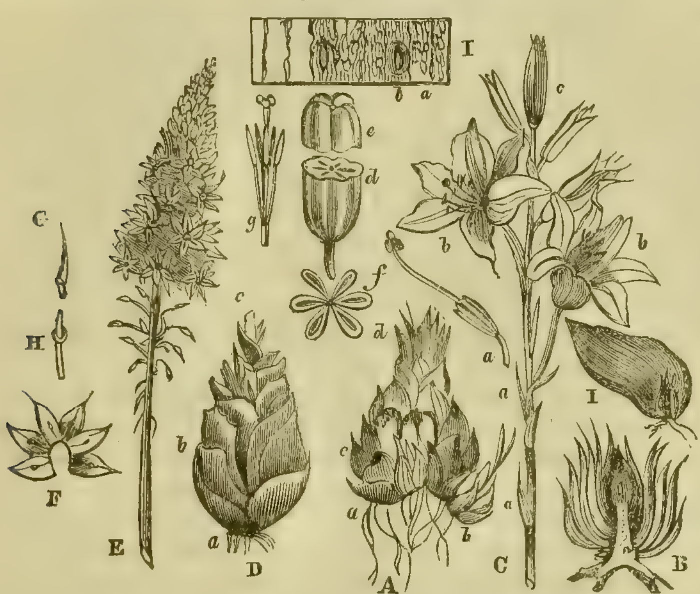


A. An aged tree. B. A younger one, to shew the columnar stem and terminal tuft of leaves. B. A branch, with its crown of foliage and flowers. D. Flowers separated. E. A stamen attached to one of the pieces of the hexapetaloid perianth. F. Stamen separate. G. The pistil. H. The fruit.

estates, and to note the bounds of territorial property; hence its specific name. It yields a syrup-like juice, from which sugar may

be obtained: the Sandwich Islanders prepare an inebriating liquor from this sap, which the Tahitians call *ava;* and the English have converted it into a sort of rum. The root of the plant is esteemed by the Javanese as a valuable medicine in dysentery.

(1194.) LILIACEÆ. *Lilium*, and its more immediate allies, *Tulipa*, *Polianthes*, *Fritillaria*, *Hemerocallis*, and other liliacinous plants, with large and highly developed petalöid perianths, introrse anthers, three-celled polyspermous capsules, and seeds with



A. Scaly bulb of *Lilium candidum*. (*a*) Roots proceeding from the lecus. (*b*) Young bulb or offset. (*c*) Scales of the bulb. (*d*) Bases of the leaves.

B. Section of the bulb, to shew the lecus, the scales, and the bud on the abortive axis. I. A scale, with a small bulb in its axilla.

C. The summit of the stalk, with flowers. (*a, a*) Bracteæ. (*b, b*) Opened, (*c*) unopened flowers. (*a*) Pistil denuded of the perianth. (*d, e*) The capsule, shewing its cells. (*f*) Seeds. (*g*) Stamens and pistils in an early stage.

I. Portion of the cuticle, to shew the stomata.

D. Bulb of *Ornithogalum Squilla* [Scilla maritima]. (*a*) The roots, (*b*) the scales, (*c*) the stem. E. Raceme of flowers. F. Perianth with stamina. G. A bracte. H. Pistil, shewing germen and style.

soft, membranaceous or spongy testæ, are associated to form this type, which, although it retains the title of the former unwieldy group, is, by the exclusion of the *Pontederiaceæ*, *Aphodelaceæ*, *Colchicaceæ*, *Smilaceæ*, and *Dioscoraceæ*, not only very much reduced in extent, but relieved of its complexity.

(1195.) From the *Asphodelaceæ* it is distinguished by the more highly developed state of the perianth, and the soft membranace-

ous seedcoats; from *Colchicaceæ*, by the introrse anthers; from *Smilaceæ*, by the more petaloid perianth, capsular fruit, and single style; from *Dioscoraceæ*, by the superior germen; and from *Pontederiaceæ*, by the irregular perianth of these latter, the pieces of which become involute after flowering.

(1196.) The Liliaceæ thus defined include *Hemerocallis*, and part of the *Hemerocallideæ*, of Dr. Brown, the other genera of which order, as Aloe, from the crustaceous texture of their seedcoats, have been associated with the Asphodelaceæ.

(1197.) *Lilium*, the normal genus of the type, contains some of our most splendid and favourite garden plants, such as the White Lily, the Tiger, the Japan, the Superb, the Orange, the Turk's cap, and other species. They are chiefly cultivated as ornamental plants; but their bulbs contain mucilaginous and farinaceous matter, and, although slightly bitter, are eatable. Some of them are cultivated abroad as the potato is here, and commonly fed on in Siberia: such as the *L. Kamtschatchense*, *L. martagon*, *L. pomponium*, and *L. candidum*. In this country they are frequently used for emollient poultices. The scent of the lily is so powerful, that it distresses many people to have the flowers near them, especially in a room; and Murray mentions some cases in which death has been caused by the odour of these plants.

(1198.) *Tulipa*, a corruption of the Persian word *Thoulyban*, is the name given to a genus of very shewy scentless flowers, which have been rendered famous from the commercial gambling of the Dutch in the seventeenth and eighteenth centuries. To such an excess were fictitious speculations then carried, that the madness of the period was not inaptly termed Tulipomania. Single bulbs were bargained for, to be bought or sold, for upwards of 500*l.* a-piece; but the plants themselves were seldom either delivered or received, the difference in their value, like the difference in the price of stocks, being lost or won according as such and such tulips were quoted higher or lower in the market at the time contracted for than the price agreed on. When the delirium began to subside, the bulbs were proffered instead of cash, and then their nominal value quickly sank, the bubble burst, and tulips were banished to the garden from the Stock-exchange.

Many hundred varieties of tulips are known, some of which are very splendid flowers.

(1199.) The different species of Yucca, or Adam's needle, Hemerocallis, or day-beauty, and Polianthes, or tuberose, are general favourites as ornamental plants. The Tuberose is famous for the fragrance of its flowers, which is the most powerful in the evening. Like the Tropæolum, the petals of this plant have been observed occasionally to emit sparks, supposed to be of electric origin.

(1200.) Colchicaceæ. The genera *Colchicum*, *Melanthium*, *Hermodactylum*, *Helonias*, *Veratrum*, *Gloriosa*, and other Liliacinæ, with extrorse anthers, distinct styles, and subdiscrete carpella, form a type, which has been named after several of the included genera, such as *Veratrum*, *Merendera*, and *Melanthium*; but perhaps De Candolle's term Colchicaceæ is preferable to any of the others.

(1201.) So similar are these plants in their general characters to the Liliaceæ, that some botanists have proposed to conjoin the types; but their properties are so dissimilar from those of the true lilies, and so peculiar to this group, that it would be a matter of regret if they could not be systematically kept apart.

A. *Colchicum autumnale*, or Meadow Saffron. (*a*, *a*) The lecus, or bulb plate. (*b*) The radicles springing from the lecus, or abortive descending axis. (*c*) The solid bulb. (*d*) The radical tube of the perianth. (*e*) The tube, with the pistil passing down it. (*f*) The limbus, or border of the perianth, composed of six connate pieces, and shewing the stamens within.

B. The foliage (*a*), with the young fruit (*b*).

C. The capsule, three-celled, with central placentæ.

D. Transverse section of a bulb, (*a*) rootlets, (*b*) cormus, (*c*) radical tube.

E. Longitudinal section, (*a*) cormus, (*b*) tube.

Veratrum album. F. Amplexicaul leaf. G. Summit of stalk, with flowers. H. Flower divested of perianth, and shewing (*a*) stamens, (*b*) pistils. I. Stamineous flower, (*a*) bracte, (*b*) perianth, (*c*) stamens. (J) Stamens divested of perianth. K. A single stamen, (*a*) filament, (*b*) anther dehiscing.

The active principle almost peculiar to these plants, and which gives to them their power, has been called *veratrin*. It is blended in the cormus of the common colchicum with a great deal of amylaceous matter, which, when it has been removed by boiling, is nutritive, and is said to be then eatable, although, when taken raw, it is highly poisonous. The virulence of these plants differs, however, in different seasons, and is varied by situation. Travellers assert that colchicum is eaten in Carniola, in the autumn, without inconvenience.

The Hermodactyl of the Greeks is believed to have been either a species of colchicum, or an allied genus. It was a celebrated remedy for the gout in ancient times, and has again recovered its celebrity, being one of the reputed bases of the "Eau medicinale." The poisonous principle pervades every part of these plants, being found not only in their roots, stem, and leaves, but also in their flowers and seeds.

(1202.) The Colchicaceæ are evidently transitional from the Liliaceæ to the Smilaceæ; for the solid bulb, or *cormus*, of colchicum is formed by the axis not being so far abortive as in the *lecus* of the true bulb; and in Veratrum the descending axis is prolonged so as to constitute almost a fusiform root, with the rootlets lateral instead of being crowded on the base, as when the rootstock is aborted. In Veratrum, too, the perianth becomes rather less petaloid; and in Campynema the germen is inferior, as in Dioscoraceæ.

(1203.) Smilaceæ. The *Smilaceæ*, including Smilax, Ruscus, Trillium, Paris, and other less important genera, are, on the one hand,

A. *Paris quadrifolia,* entire plant, shewing the creeping rootstock, the four verticillate leaves, and the flower. (*a*) The fruit and perianth. (*b*) Section of the fruit. (*e*) Perianth, stamens, and pistils. (*d, e*) The germen, surmounted by four stigmata.

B. *Smilax sarsaparilla.* C. *Smilax China.*

associated with the *Dioscoreaceæ* by their broad leaves with reticulated veins, common to several genera, and, on the other, with the *Asphodelaceæ* by their generally perigynous, introrse anthers, and superior three-celled ovarium; so that they have frequently been combined, either wholly or in part, with both. The characters, however, which associate them most strongly with either, distinguish them from the other: thus, the superior ovarium takes them from Dioscoraceæ, and the broad reticulated leaves from Asphodelaceæ; and such genera as have the foliage not reticulated, are known by the triple style and membranous testa, which latter is characteristic of, and common to, all the Smilaceæ. The Smilaceæ, thus characterised, are divided into two subtypes: 1st, the *Smilacidæ*, in which the stigma is simple or three-lobed, as in Smilax, Ruscus, and Convallaria; and, 2d, the *Parisidæ*, in which the several stigmata are distinct, as in Paris, Trillium, and Medeola.

(1204.) *Parisidæ*. *Paris quadrifolia*, which is an indigenous plant, and *P. polyphylla*, a native of Nepal, are both poisonous, the latter more especially so. *Trillium* likewise, which is curious for the threefold arrangement of all its parts, the stem being three-leaved, the calyx three-sepalled, the corolla three-petalled, the stamens twice three, and the pistil with three styles, is a suspicious plant; its roots are violently emetic, and its fruit deleterious. The properties of this subtype seem to bring them nearer than the Smilacidæ to the Colchicaceæ.

(1205.) *Smilacidæ*. Various species of the genus Smilax are esteemed for their alterative properties; they are tonic, diuretic, and demulcent. *Smilax aspera* is by some preferred to the drug we use under the name of sarsaparilla. The so-called sarsaparilla of the druggist is not, however, the produce of *S. sarsaparilla*, but of *S. sarza*, as the species is now named. The large fleshy subrotund rootstock of *S. china* is eaten in the Celestial Empire instead of rice; and the Abbé Rochon attributes the corpulency of the Chinese in part to its consumption.

MUSALES.

(1206.) *Musa*, *Urania*, *Heliconia*, *Thalia*, *Iris*, *Agave*, *Aglaia*, and the numerous other names of classical celebrity conferred upon the plants included in this order, would seem to be indicative of the admiration which their magnificent and graceful port, their

curious structure, and their splendidly beautiful flowers are well calculated to excite, and the homage which they appear universally to command. For, notwithstanding some stern etymologists suppose *Musa* [§ 75, B,] to be a corruption of *Mauz*, the Arabic name of the plant, while antiquarians consider it to be commemorative of *Antonius Musa*, the freed-man of Augustus, and *Thalia* of a German physician, still the correlatives *Heliconia*, *Urania*, and

Urania Ravenala.

A. Entire plant. (*a*) Columnar stem, marked with the scars of the fallen leaves. (*b*) Leaves, with their vaginal petioles and lacerated expansions. (*c*) Leaves entire during early growth.

B, C. Flowers separated. D. Transverse section of the three-celled fruit. E. Longitudinal section of seed, shewing the included embryo. F. Transverse section of the same. G. The seed, with the arillus removed. H. A seed, with the arillus.

Aglaia, sufficiently shew in what sense they have been ordinarily taken; and, if terms of exuberant praise are fit denominations for any plants, they are not undeserved by these.

(1207.) The inferior fruit, with a tripetaloid or hexapetaloid perianth adnate to the germen, are the chief characters which associate the genera included in this large order. But, although agreeing for the most part in these common characters, they differ

in the structure of their leaves, the development of the perianth, the presence or absence of albumen, the union of the stamens with the pistil, and other particulars by which they are distinguished into fifteen types, associable into five sections, called TACCINÆ, NARCISSINÆ, SCITAMINÆ, ORCHIDINÆ, and HYDROCHARINÆ.

TACCINÆ.

(1208.) *Tacca* and *Ataccia*, with *Dioscorea*, *Tamus*, and *Testudinaria*, are illustrations of the section TACCINÆ.

(1209.) The genera included in this first section of the Musales are associated into the two types *Dioscoraceæ* and *Taccaceæ*, which seem to be intermediate between the present and the two preceding orders. Indeed, the Dioscoraceæ have most commonly been placed among the Liliales, next to the Smilaceæ; and the Taccaceæ blended with the Acorinæ, or Aröideæ, of the Juncales. Their inferior fruit will, however, sufficiently distinguish them from both these orders; and the petaloid perianth of the latter forbids its intimate association with the achlamydeous or glumaceous sections.

(1210.) Differentially considered, the Taccinæ are hexapetaloid monocotyledons, with inferior ovaries, large grumous roots, or rhizomata, and petiolate, pedatinerved, pinnatifid, or subreticulated leaves. And, although differing considerably in habit and in appearance, the dissimilarity of both from the other sections in this order tends to strengthen the association which their agreement in these various particulars suggests.

(1211.) TACCACEÆ. *Tacca* is the Malay name of a genus, of which there are but two known species. One of these, the *T. pinnatifida*, is a most important plant, as affording food to the natives of the South Sea Islands, where corn and our esculent grains are unknown. The part chiefly eaten is the enlarged root-stake, that, like the yam and some of the Aröideæ, contains much farinaceous matter, which, washed and well prepared, is both palatable and nutritious. In their raw state the roots are bitter and acrid, and require to be rasped fine, and steeped in several waters, before the acrimony is removed. Thus prepared, the meal is made into cakes and loaves, being even preferred to sago bread. The leaf-stalks, when boiled, become mild, and are, when thus cooked, esteemed as food in China and Cochin-China. When beaten into a soft pultaceous mass, these roots form excellent poultices.

(1212.) The *Taccaceæ* are large, perennial, herbaceous plants, with tuberous rootstakes, and shortened or abortive superior axis; having exstipulate, radical, petiolate, pedatisected, pinnatifid, or rarely entire leaves, with a curvilinear venation. The flowers are united, hexandrous, and the filaments free but dilated; the tube of the perianth adnate to the germen; the limbus six-parted, petaloid, and persistent; ovaria three, and connate; the fruit baccate, indehiscent, unilocular or subtrilocular, and many-seeded, with parietal placentæ. Seeds lunate or subovate, testæ striate; and the embryo situated on the outside of the fleshy albumen.

(1213.) The radical leaves, and baccate fruit, with parietal placentæ and lunate or subovate seeds, are the differential signs of this type, when added to the common characters of the section.

(1214.) DIOSCORACEÆ. This, once arranged as the concluding type of the Liliacinæ, indicates by its characters the transition to another order. The perianth is the least petaloid and the most herbaceous of the whole series; the genera agree in habit, and in the venation of their leaves, with the Smilaceæ, but are distinguished by their inferior fruit, which associates them with the MUSALES. The leaves are peculiarly reticulate, resembling closely those of Exogenous or Dicotyledonous plants, hereafter to be described; and they differ, on the whole, in so many particulars from other tribes, that they would seem to occupy the neutral ground, rather than of right to be classed with any.

(1215.) A small herbaceous or subpetaloid perianth, regular and spreading; separated flowers; inferior germen; baccate or capsular fruit; albuminous seeds, and small embryo, included in a large cavity of the cartilaginous albumen, are the associating characters of this type, and those which distinguish it from all others. The plants have a climbing habit, and alternate leaves, that are either reticulate or palmatinerved.

(1216.) *Dioscorea*, the yam, and *Testudinaria*, the Hottentot's bread, are the most important genera in the type. *Tamus*, the black briony, is the only European representative. The roots of *Tamus communis* are large, and replete with fecula, which is however mixed with a bitter acrid matter, that renders them unpleasant to the taste, and probably unwholesome. Heat and repeated washing will, however, destroy all the bitterness and acridity, and the fecula which remains forms a nutritious food. Attached to the roots of Tamus are blackish tumours, which should be removed from those intended to be eaten; for they are so exceedingly acrid, that, when beaten into a pultaceous mass with the rest of the root, they have been used as stimulating plasters. The young shoots of this plant

have a mild agreeable flavour, and form a very good substitute for asparagus. By the Moors they are boiled, and eaten with oil and salt.

(1217.) Several species of *Dioscorea*, or yam, such as the *alata, sativa,* and *aculeata*, are cultivated in warm countries as the potato is with us. Their roots are very large, sometimes weighing even as much as thirty pounds. Like the briony, when fresh, they contain an acrid juice, which causes itching if applied to the skin, but, being mixed with so much more fecula, it is less irritating than the Tamus. By heat this acrid principle is wholly dissipated, and either boiled or roasted they form a light, nutritious, palatable food. They are very mealy, and can be made into either bread or puddings, and are not inferior in flavour to any such vegetables now known. In Tahiti a favourite dish is made of yams, with scraped cocoa-nut and the pulpy fruit of the Banana.

Testudinaria elephantipes.

(*a*) Flower.

(*b*) Rootstock, voluble stem, and reticulate leaf.

(1218.) The *Testudinaria elephantipes*, or Hottentot's bread, [§ 1220,] is a very curious plant, resembling in its rootstock a tortoise encased in its protective shell. My friend, Mr. Burchell, to whom we are so much indebted for information collected during his travels in Africa, tells me he met with it frequently; and in times of scarcity the Hottentots break off the woody case, and eat the pithy substance it contains, whence the name Hottentot's bread.

NARCISSINÆ.

(1219.) The angular and sedge-like leaves of some of the *Ephemerinæ* prepare the way for the sword-shaped foliage which prevails in the several groups of plants which have, from this circumstance, been denominated ENSATÆ, and which, although divided into separate orders by many persons, are more naturally and conveniently collected into one section; subdivisions of which they will be here considered.

(1220.) The *Narcissi* and *Amaryllides*, with the corn-flags, or *Irides*, [§ 75, D, E,] saffrons, or *Croci*, and the pine-apples, or

Bromeliæ, are familiar illustrations of this section, and of three out of the four types that it contains, viz. *Bromeliaceæ*, *Amaryllaceæ*, and *Iridaceæ:* the fourth type, *Burmanniaceæ*, includes only exotic plants, such as *Hæmodorum*, the blood-wort, *Dilatris*, *Burmannia*, and others; no British representative being known.

(1221.) Differentially considered, the *Narcissinæ* are tripetaloid or hexapetaloid *Mucales*, with triandrous or hexandrous flowers, central placentæ, albuminous seeds, and nervo-striated leaves.

(1222.) Bromeliaceæ. *Ananassa*, the pine-apple, with Bromelia, the genus in which it was formerly included; the *Agave*, or American aloe; the parasitical *Tillandsia*, *Pitcairnia*, &c., constitute two sub-sections of a group denominated, from its normal genus, Bromeliaceæ. In the two last-named, and some contingent genera, the ovary is superior or free, while in Bromelia and others it is inferior; and hence the type has been subdivided into the *Bromelieæ*, or *Bromelidæ*, and the *Tillandsieæ* or *Tillandsidæ*.

(1223.) The Bromeliaceæ shew some similitude, especially by the habit of Agave, to *Yucca* and *Aloe* contained in a preceding order. As a type, they are distinguished from the others in the same section by having only the three internal pieces of the perigonium delicately petaloid; the three external being herbaceous, and peculiarly harsh and rigid. The six stamens will likewise distinguish the Bromelidæ from Iridaceæ, and other sections in which the ovarium is inferior; and the Tillandsidæ, in which the ovarium is superior, are well known by the three-celled, many-seeded berries or capsules, and the farinaceous albumen of the seeds, as well as by the distinction of perigonium into calyx and corolla, which contrasts these latter with the Amaryllaceæ, to which they are otherwise allied. The similarity of the leaves of Bromelia, Ananassa, &c. to Stratiotes and Pandanus, cannot escape the least observant: it is one of the many links which associate the different provinces of the vegetable world.

(1224.) *Tillandsidæ*. As some few of the Liliales prefigure the characteristic development of this order, by having the perianth adnate to the germen, so some few of the genera included among the Musales reflect, or relapse into, the structure which is chiefly differential of the Liliales. Of this the Tillandsidæ afford an apposite example; for, although associated with the Bromeliaceæ, their perianths are free and fruit superior.

(1225.) *Buonapartea*, *Guzmannia*, *Tillandsia*, and the other genera included in this subtype, are all either elegant or very curious plants: the first, named after Napoleon the emperor, has little besides its external shewy appearance to recommend it. The Tillandsiæ, dedicated to the memory of Elias Tillandsius, professor of physic at Abo, and author of the "Flora Aboensis," are much more intrinsically important.

These curious plants, one of which *(Tillandsia utriculata)*, the wild pine of the colonists, is a native of Jamaica, and of the greatest service to the inhabitants of that hot climate, either during their journies into the woods, or in any scarcity of water: for its leaves are channelled, three feet long and upwards, and enclosed within one another, so as to convey all the water they catch upon their expansions down to their bases, which swell out and form a reservoir, or bottle, so contracted towards the neck, that evaporation by the heat of the sun is in a great measure prevented. The basins or cisterns formed by the concave inner surfaces of the leaves will each hold about a quart of water, which, although primarily designed for the sustenance of the plant, is found to afford very seasonable supplies to both men and animals. Birds and insects come in troops to these vegetable tanks, and travellers apply to them for relief. Dampier, in the account of his travels, says, "The wild pine is a plant so called because it somewhat resembles the bush of leaves which surround the true pineapple. The wild pines commonly grow from some bunch, knot, or excrescence of a tree, where they take root, and spring upright. The root is short and thick, from whence the leaves rise up in folds one within the other, spreading often to the top of the tree. They are of a good thick substance, and so compact as to catch and hold the rainwater when it falls. They will contain a pint, or a pint and a half, or a quart, and this water refreshes the leaves and nourishes the root. When we find these pines," continues our traveller, "we stick our knives into the leaves, just above the roots, and let out the water, which we catch in our hats, as I have done many times myself, to my great relief."

The seeds of these plants are furnished with long pappose hairs, which, streaming in the wind, attach the seeds, when borne away, to the branches of the trees on which they are to grow; for the Tillandsiæ are parasites, and without some such contrivance their seeds would be cast on the ground, and never be conveyed to the only soil on which they can flourish.

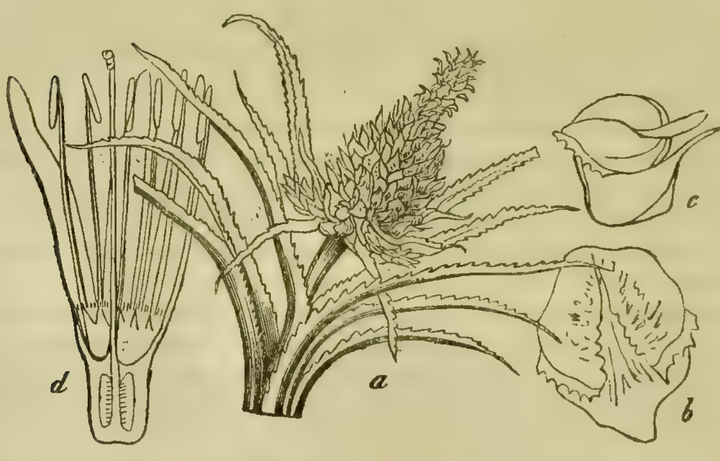
(1226.) Another species, likewise a native of Jamaica, which, from its resemblance to *Usnea*, the old *barba Jovis*, or tree-beard, has received the name *T. uneoides*, is a very curious plant. Its stems are pendent, no thicker than threads, often curled, and hang down from the branches of the ebony trees like tufts of hair, a yard long. Within these stems there is found a tough black filament, no thicker than a horsehair. These parasites are collected, and exported from Jamaica to North America, for the use of upholsterers, saddlers, and coachmakers, who use them, when prepared, instead of horsehair to stuff seats, cushions, panels, mattresses, &c. The manufacture consists in tying the stems in bundles, and steeping them in water, or burying them in a wet place, until the outer and softer parts have rotted, so that they can be easily removed or washed away; they are then boiled until clear of the refuse parts, and substituted for horsehair, from which they are with difficulty distinguished, unless the branching of the fibres be accurately examined. The Bonana birds' nests, which are found suspended by a few

threads from the expanded branches of large trees, and especially such as grow over ponds or lakes, are said to be always made of the fibres of this plant.

(1227.) Bromelidæ. The genus Bromelia has lost much of its interest and importance since the pine-apple has resumed its original Peruvian name, *Nanas*, now latinized *Ananassa*. The various species are remarkable for their power of subsisting for a long period on the fluids they contain, or on what they can absorb from the atmosphere, without any communication with the earth. Hence they are favourites with those who patronize hanging gardens, and in Mexico are commonly suspended to the balconies, for the sake of filling the houses with their delightful fragrance. Some of the Bromeliæ are planted as hedges, and the leaves of others, as the Grewatha, are made into ropes.

(1228.) The pine-apple (Ananassa), which by common consent is esteemed the most excellent of fruits, has not been known in Europe above two hundred

Ananassa sativa.



Ananassa sativa [olim *Bromelia ananas.*] *(a)* Foliage and inflorescence. *(b, c)* Bractea investing the flowers and fruit. *(d)* Section of flower, to shew the inferior germen, stamina, and pistil.

years, and not cultivated in Britain for more than a century. But at the present time pines may with more certainty be procured any day in the year in London, than in their native country, and, it has been asserted, of a finer flavour. The fruit of this plant is compound, and consists of numerous concrete ovaria, blended into a common mass with the adnate perianthia become succulent. The malic and citric acids, which give to the pines, when they are fully ripe, their exquisite flavour, are so abundant before maturity, that the unripe juice is said to have even caustic properties; and at all times is so powerful as to corrode the knives with which the fruit is cut. In tropical countries pines are recommended in diseases of the kidneys, but, although a most pleasant form of medicine, the cost will prevent its frequent exhibition here.

Pines are chiefly propagated by suckers, and, from the crown or tuft of leaves which surmounts the mass of fruit, and which is a continuation of the general axis, prolonged after the development of the flowers, and this, when planted, grows, and forms in time another mass of flowers and fruit: by proper treatment, this elongation of the axis, and extension of the individual, may be carried to an indefinite extent.

(1229.) The different species of *Agave*, [§ 75, c,] especially the *A. Americana*, or American aloe, have long been favourite greenhouse plants in England, and have even been acclimated in the southern parts of Europe. Indeed, so essential an ornament is the American agave considered in Italy, that near Milan, and in other parts of Lombardy, where it will not endure the winter, imitations of it are made, and so well constructed and painted, that they are usually mistaken for real plants. The old and absurd notion that the Agave flowers only once in a century, is scarcely worth contradicting. Several have blossomed in the neighbourhood of London within the last few years, and been made the subjects of public exhibitions. The slowness of the general growth of the foliage, and the rapidity with which these plants send up their flowering stem, (fifteen or twenty feet in height, within the space of a few weeks,) is a circumstance worthy observation. In the West Indies, and even in Spain, Portugal, and Sicily, hedges of Agave are common.

(1230.) A substitute for soap is made from the leaves of the Agave Mexicana, by expressing the juice, and boiling it to a proper consistence. This soap, it is said, will wash as well with salt as with fresh water, but must not be mixed with oil or other fatty matter. The fibrous structure of the leaves of these plants, when prepared, by bruising and steeping them in water, are converted into thread, which is made into cords, and various kinds of coarse cloths.

(1231.) The Agave Americana abounds with sap, which flows freely from wounds made either in the roots or the leaves, even for months together. This sap contains much sugar, which is converted into syrup, or obtained in a solid form, by evaporation. When allowed to ferment, this juice becomes changed into a sort of wine called *pulque*, but large quantities are consumed in an unfermented state; the plants being tapped, and bucketsful carried to the markets daily.

(1232.) AMARYLLACEÆ, or NARCISSACEÆ. *Narcissus*, *Amaryllis*, *Galanthus*, *Leucojum*, and the other genera included in the type called indifferently either *Narcissaceæ* or *Amaryllaceæ*, afford another series of beautiful gradations in the change of the floral integuments into what Linnæan botanists term a *nectary* (nectarium.)

(1233.) Nectary is a word invented by Linnæus, and conveniently employed to designate a further change of the parts of fructification beyond that which gives the normal character of calyx or corolla, and yet when the so far developed parts have not assumed the form or functions of stamina or pistils: hence nectaries are usually scales, or filaments, but frequently undeveloped or only half evolved petals or stamens are included, and sometimes especial organs are discovered. Thus in the snow-flake, *Leucojum*, all the six pieces of the perigone are equally developed,

but in the snow-drop, *Galanthus*, the three internal are small and emarginate, and have been sometimes, though improperly, called nectaries; while in Narcissus, besides the six pieces highly coloured that form the perigone, there is a cup or crown which constitutes a Linnæan nectary [§ 75, E.] In cultivated flowers this cup or nectary is often resolved into a whorl of additional petals, occasionally into a whorl of additional stamens, and in Gethyllis, which is a polyandrous genus, this metamorphosis is constant. The nectary, however, is not always a separate organ, for as the sepals and petals are often confounded together and indistinguishable, so likewise the nectary is often a part of the calyx or corolla, and is sometimes not separable from them.

(1234.) The *Amaryllaceæ*, like several of the contingent sections, have the axis abortive or nearly so, and the caudex contracted into a plate (lecus), whence a tuft of leaves arise, the bases of which becoming succulent constitute a bulb. Hence most of the genera here associated are bulbous plants; in some, however, as Clivia, Doryanthes, and Alstroemeria, the axis descends at once without forming a plate, and divides into numerous rootlets. The foliage of these plants is radical, the leaves somewhat sword-shaped and with parallel linear veins; the flowers are generally enclosed in a large bracte or spathe, but sometimes several bracteæ terminate the flower-stalk, when the inflorescence is in a sertulum or simple umbel. The perianth is six-parted, and the corollaceous sepals equitant in æstivation. The stamina are six in number, either free or monadelphous; the germen is inferior, three-celled, and generally many-seeded; the fruit a capsule or berry, which occasionally by abortion is only one-celled; the style is simple and the stigma either simple or three-lobed; the seeds have either membranous or crustaceous testæ, and contain a cylindrical embryo included in a fleshy albumen.

(1235.) The genera associated to form the type *Amaryllaceæ* have been distributed into two subtypes or subordinate groups, in one of which the seeds have black crustaceous testæ and a rostellate hilum; in the other the seed-coats are soft and spongy, and the seeds beakless. *Hypoxis* is the normal genus of the former, Amaryllis of the latter group, which hence are called the *Hypoxidæ*, and *Amaryllidæ*.

(1236.) Collectively considered the *Amaryllaceæ* are hexapetalous Narcissinæ with six or more stamens, and with ensiform, non-equitant leaves: the above characters are therefore both their associating and differential signs.

(1237.) *Hypoxidæ*. *Hypoxis*, withdrawn from *Asphodelaceæ* by Dr. Brown on account of its inferior ovarium, seems to be a link of connexion between them and the *Amaryllaceæ*, with which it is combined by Richard, and from which it very slightly differs; the hard dark brittle testa, to the seeds and indehiscent capsule, being the chief marks of distinction of the subtype *Hypoxidæ*. The foliage of these plants is plaited, harsh, and rigid, which circumstances seem to argue them distinct from both *Amaryllidæ* and *Asphodelaceæ*, and hence they are admitted as a subtype, although a more distant separation does not seem advisable. *Hypoxis*,

Curculigo, and their very few allies at present known, are natives of New Holland, the East Indies, the Cape of Good Hope, and

Hypoxis stellata.

A. Entire plant.

(*a*) Pistil.

(*b*) Fruit of H. decumbens.

(*c*) Transverse section of the fruit.

(*d*) Seed.

(*e*) Section, to shew the included embryo.

North America. They are plants of little beauty, *H. stellata* excepted; and hitherto unapplied to any useful purpose.

(1238.) *Amaryllidæ.* Amaryllis, Hæmanthus, Nerine, Bruns-

Alstroemeria pulchella.

Cutting in flower; stamens and pistils denuded; with pieces of the petaloid perianth.

vigia, Galanthus, Leucojum, Crinum, Pancratium, Narcissus, Alstroemeria, and the numerous other genera included in this subtype, are among the most ornamental plants of our gardens

and conservatories. They are likewise remarkable for the acrid or poisonous properties of the majority, associated as they naturally are with other types and sections, in an order and a series of classes celebrated for the abundance of wholesome food they furnish, and the prevailing absence of deleterious qualities.

The narcotic odour of the Narcissus was known to the ancients, indeed its name is said to be derived from (ναρκη,) stupor; and hence it was one of their funereal flowers. The smell of many is, however, exceedingly grateful; but in confined apartments their exhalations are reputed to be noxious. The bulbs of these plants abound more or less in farina, containing an emetic principle, which in some, as the N. poeticus, N. Jonquilla, &c. is so predominant, that they were called *bulbi vomitarii* by the older herbalists. *N. odorus*, *Pseudo-narcissus*, and *Tazetta*, have similar properties, and are administered on the continent in doses of five or ten grains to produce nausea, and thirty grains as an emetic.

The extract is the best form in which the active principle of the Narcissi can be exhibited medicinally. Two or three drachms of this preparation will destroy life in the course of a few hours. In doses of two or three grains, it is regarded by some persons as almost a specific in hooping-cough. But Laennec says, in speaking of its effects in pertussis, "I have used this extract much, and have occasionally seen it effect surprisingly rapid cures; for instance, in five or six days; but this result is rare, and as a general remedy I find it much less efficacious than Belladonna.

(1239.) The different species of Amaryllis are more or less poisonous, and *Hæmanthus toxicarius*, the old A. toxicaria, is the plant with which it is said the Hottentots poison their arrows. Weapons wetted with the juice of the bulb convey certain death by the slightest wound; dissolution is preceded by violent struggles, and efforts to vomit. The flesh of animals thus slain is not deteriorated, but is eaten by the natives. *Nerine sarniensis*, the Guernsey lily, which became naturalized in the islands of Jersey and Guernsey many years ago, by the wreck of a vessel from the Cape, is also reputed to be poisonous. Amaryllis ornata is said to be astringent; *Alstroemeria salsilla* is considered useful as a diuretic and diaphoretic: and A. Ligtu is esteemed for its scent, it being as grateful as mignionette. A. salsilla is cultivated in the West Indies and in America, especially in Peru, for the sake of its roots, which are there eaten as the tubers of the potato are in Europe. It is worthy of note that the Amaryllidæ lose much of their fragrance when the flowers become double, which is precisely the reverse of the multiplication of the petals in Rosaceous plants.

(1240.) Burmanniaceæ. Certain exotic genera, such as *Burmannia* and *Maburnia*, with *Hæmodorum* and *Dilatris*, *Barbacenia* and *Wachendorfia*, which, although transitional between *Amaryllaceæ* and *Iridaceæ*, would form exceptions to the characters of those types if included in either, have been associated into two small groups or subtypes, the *Burmannidæ* and *Hæmadoridæ*, which form, together, the type Burmanniaceæ.

(1241.) Differentially considered, the *Burmanniaceæ* are tri- or

hexapetaloid Narcissinæ with mostly equitant leaves, æstivation rarely equitant, the tube of the perianth either winged or hairy, and the stamens in general six, rarely many, and if reduced to three, placed opposite the internal pieces of the perianth.

(1242.) Those genera in which the stamens are variable in number, the anthers introrse, and the perianth pilose, are associated to form the subtype *Hæmadoridæ*, while those in which the flowers are triandrous, the anthers dehiscent transversely, and the perianth angled or winged, constitute the subtype *Burmannidæ*.

(1243.) Hæmodoridæ. *Hæmodorum*, *Dilatris*, and *Lanaria*, with *Vellozia*, *Barbacenia*, *Xerophyta*, and other exotic genera which form the present subtype, are tri- or hexapetalous *Narcissinæ*, with the tube of the perianth externally covered with hairs or wool, and the æstivation rarely equitant, the stamens three, six, or more in number, (if only three, opposite the internal segments of the perianth,) the anthers two-celled and introrse, the germen inferior, in all except Wachendorfia, the fruit capsular, the seeds with smooth membranous or coriaceous testæ, the albumen cartilaginous or fleshy, and the embryo small and remote from the hilum.

The *Hæmodoridæ* are herbaceous perennial plants, with fibrous or fasciculated fibrous roots. Often with the superior axis abortive, the leaves alternate, ensiform, and mostly equitant. They are chiefly stemless, but the Velloziæ have dichotomous trunks and tufted leaves. This subtype is evidently transitional, the variable number of stamens connecting it both with *Iridaceæ* and *Amaryllaceæ*, the equitant leaves with the former, and the occasionally equitant æstivation with the latter. The *Hæmodoridæ* are many of them handsome shewy plants; the roots of several, as *Dilatris tinctoria*, *Hæmodorum*, and *Wachendorfia*, yield a red dye; but they are not of any great economical importance.

(1244.) Burmannidæ. If separated from the *Hæmodoridæ* or *Iridaceæ*, with both which and Bromeliaceæ they are connected, the genera *Burmannia* and *Maburnia* will form a very small and unimportant group, chiefly characterized by the transverse dehiscence of their adnate anthers, and their three stamina being opposite the interior pieces of the perianth, by which, although associated to *Hæmodoraceæ*, they are distinguished from *Iridaceæ*. Jussieu placed the genus Burmannia among the Bromeliaceæ, Martius has pointed out its affinity to *Hydrocharinæ*, and Bartling to *Hypoxidæ* and *Hæmodoridæ*, with which it is here conjoined in a com-

mon section. They are homely-looking plants, the properties of which have not been investigated, and the uses, if any, are at present unknown.

(1245.) IRIDACEÆ. The *Iridaceæ* or flowering-flags, including *Crocus*, *Gladiolus*, *Iris*, *Tigridia*, and numerous other allied genera, are plants of peculiar interest, as to the modifications of structure they present both in the organs of vegetation and fructification.

(1246.) The intermediate caudex of the crocus, which is usually considered as a solid bulb, is rather a rhizoma, from the bottom of which the roots proceed, and upon which the buds are situated; this axis neither lengthens upwards nor downwards to any considerable extent, for the buds separate and the old rhizoma perishes; but in Iris this rhizoma is not subterranean but prostrate on the surface of the soil, and each successive yearly growth, instead of dying, continues to connect the foregoing which have been formed by the successive crops of buds, and thus produces a mass of stem of considerable extent, sometimes simple, and sometimes, according as more or fewer buds are developed, variously branched; and this rhizoma, which in the iris is naturally prostrate, may be considered as a forerunner of the elevated stems of palms; and accidentally prostrate palms, as Elais melanococca, [§ 1081,] which send out inferior radicles, confirm the likeness; the internal structure of the one is also equivalent to that of the other.

(1247.) The foliage of crocus embraces the stem much less than the leaves of iris and sisyrinchium, which, with others like them, are said to have *equitant* foliage; and these equitant leaves, when the culm raises the flower, are converted into bracteæ, gradually becoming modified, and at last in the form of spathes enveloping the blossoms before they expand. In the genus iris the whole of the six pieces of the perianth are highly coloured, the three outer, which are reflexed and form the calyx, the most so; the three inner pieces are more erect, and constitute the corolla; within which are found three stamina covered by three petaloid pistils, which thus mark the transition of these organs into each other; the transition of leaves into bracteæ, and bracteæ into calyx and corolla, has already been noticed in several cases, *e. g.* Arum, Calla, Butomus, &c.

(1248.) The *Iridaceæ*, which form a very natural assemblage of plants, in all of which, excepting *crocus*, the leaves are equitant, rise in general from a rhizoma either extended as in iris, contracted as in crocus, or still less developed, as in those which have been described as having fibrous roots, *i. e.* where the inferior caudex is at once divided from the crown into fibres without forming even the plate of crocus, which is called a *lecus* if very thin, or a *combus* if collected into a thicker mass. The stamens in *Iridaceæ* are always three, while in the other associated orders they are generally six, the *Burmannidæ* and some few *Hæmadoridæ* only having three; but from these, as well as from all the other sections in this

district, the *Iridaceæ* are easily known by the outward dehiscence of their erect anthers. The germen is inferior and trilocular, the placentæ axial, the ovules many, and the albumen hard or horny.

(1249.) Those Iridaceous plants like *Iris*, [§ 75, D] *Crocus*, &c. which have the stamens discrete, form the subsection *Crocidæ*, while those which have them united or monadelphous, as Ferraria, Tigridia, Sisyrinchium, &c. constitute the second subsection, *Ferraridæ*.

(1250.) *Crocidæ*. Iris, Ixia, Gladiolus, Crocus, and their associates, although highly ornamental, are not very useful plants.

Saffron is afforded by the *Crocus*, which is the only genus having odorous stigmata. Good saffron should consist of the stigmata alone, and hence the number of plants required to produce even an ounce will sufficiently account for the high price this drug bears in the market. The diseases to which the Croci are subject, especially their liability to be attacked by that most destructive parasite the *Rhizoctonia*, the effects of which have been already described [§ 553], further enhance the value of saffron, and tempt fraudulent dealers to mix not only the stamina of the plants with the pistils, but also to adulterate the drug with the petals of the Carthamus tinctorius, the Calendula officinalis, and even the dried fibres of beef. These admixtures can easily be detected either by maceration, which will develop the form of the petals, or by burning a small quantity of the suspected sample, when, if dried flesh be present, it will be betrayed by the peculiar animal odour. Saffron is aromatic and stimulant, and is a favorite popular carminative; it is, however, chiefly now valued for its colouring matter, which is owing to a peculiar proximate principle called polychroite. The plants are grown in large quantities in many places. English saffron is esteemed more, and bears a higher price, than that of foreign growth. The chief saffron gardens used to be in the neighbourhood of Walden, in Essex, which hence obtained the distinctive appellation of Saffron Walden.

(1251.) Although crocus alone has aromatic stigmata, a great uniformity prevails among all these plants in the properties of other parts. Their fleshy rootstakes contain much fæcula impregnated with an acrid bitter principle; hence both Iris Germanica and psendacorus have been employed as purgatives and emetics, and the I. florentina, from its agreeable odour, to make tooth and hair powder, and to keep up the discharge from issues. Pallas says that the roots of I. dichotoma are eaten in Siberia, and, according to Thunberg, the Hottentots roast and eat the roots of I. edulis; which Sparmann adds they call *Oenkjes*, and reckon their age by the number of their nodes. The seeds of I. pseudacorus, when roasted, form a very excellent substitute for coffee. *Iris fœtidissima* affords a curious example of the tastes and distastes peculiar to different men, for its odour is thought by most persons to resemble that of roasted beef or mutton, and can therefore scarcely be allowed to merit the Linnæan specific name of *fœtidissima*.

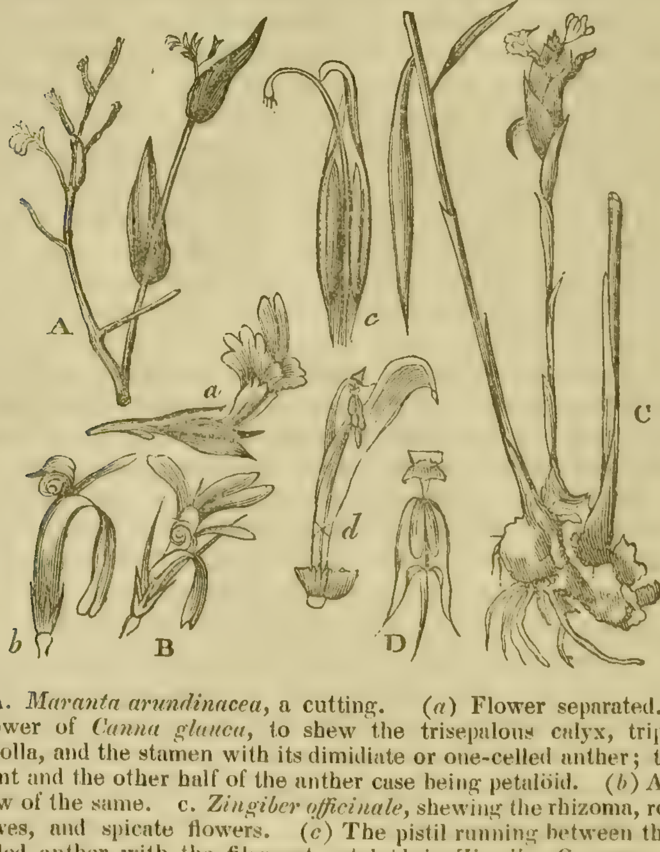
(1252.) *Ferraridæ*. *Ferraria*, *Tigridia*, *Sisyrinchium*, and the other Iridaceæ with connate filaments but distinct anthers, which are associated in this subtype, are not less, perhaps more, ornamental than even the Crocidæ. Their properties do not materially

differ from those of the preceding subtype. *F. cathartica* and *F. purgans* declare their powers by their titles, and the expressed juice of these plants is, according to Martius, given as an aperient in Brazil under the name of Field Rhubarb. Their chief interest, however, depends upon the connexion which their monodelphous structure establishes between the present section and the gynandrous *Orchidinæ*.

(1253.) Differentially considered, the *Iridaceæ* are triandrous *Narcissinæ*, with the stamens opposite the exterior pieces of the perianth, anthers extrorse and equitant, or rarely subequitant leaves.

SCITAMINÆ.

(1254.) The *Scitamenta* of the ancients were certain savoury and well-spiced viands, the elegant delicacies of the tables of those times; and hence Linnæus applied a kindred word to denominate



A. *Maranta arundinacea*, a cutting. (*a*) Flower separated. B. Flower of *Canna glauca*, to shew the trisepalous calyx, tripetaloid corolla, and the stamen with its dimidiate or one-celled anther; the filament and the other half of the anther case being petaloïd. (*b*) Another view of the same. C. *Zingiber officinale*, shewing the rhizoma, rootlets, leaves, and spicate flowers. (*c*) The pistil running between the two-celled anther with the filament petaloid, in *Zingiber Casumunar*. D. Front view, and (*d*) side view of the two-celled anther in *Curcuma zerumbet*.

a group of plants in which are included some of the most sapid and grateful condiments known. But, besides the *Gingers* and the *Cardamoms*, the present section comprehends the *Musæ* or *Bananas*; and, thus extended, it has a further claim to the collective title *Scitaminæ*, as the original word was applicable to other elegancies besides those of taste.

(1255.) The *Scitaminæ* are often large herbs, and even tree-like herbaceous plants, with perennial, tuberous, or fasciculated fibrous roots. The stems are mostly round and simple, the axis being occasionally abortive; the leaves alternate, vaginant, and penninerved. The flowers united; the perianth superior, of six pieces and irregular; the outer three more or less sepaloid, the inner ones petaloid. The stamens six, one or more often becoming petaloid and barren, the anthers one or two celled, the pollen pulverulent, the germen inferior, three-celled or rarely one-celled, with central placentæ, seeds in general many, style simple, or rather triconnate, stigma simple or three-lobed. Fruit capsular, mostly three-celled and three-valved, rarely fleshy. Albumen farinaceous or horny; and the embryo cylindrical and included.

(1256.) Differentially considered, the *Scitaminæ* are therefore tri- or hexapetaloid *Musales* with an irregular perianth, inferior germen, central placentæ, and penninerved leaves.

(1257.) The banana (*Musa*), the ginger (*Zingiber*), and the arrowroot (*Maranta*), are the normal genera of three types, called from them *Musaceæ*, *Zingiberaceæ*, and *Marantaceæ*, which are associated in the section Scitaminæ. These groups form a very interesting series both in an economical and physiological point of view, as they afford for use much grateful food, and exhibit further examples of that gradual progression of changes already pointed out so frequently, in former sections.

(1258.) *Musaceæ*. The *Bananas*, though very distinct from the palms, still in the formation of their stipites, by the bases of their immense leaf-stalks [§ 1206,] and in the gradual abortion of true stem and the contraction of the stipes to a rhizoma, they shew the progression from the short-stemmed palms to the *Zingiberaceæ* and *Marantaceæ*, with which they are more closely allied.

The foliage of the Musaceæ likewise, although differing from the longitudinally divisible leaves of palms, is an example of true transition from the Phœnicinæ to the other sections of this class; for here the general axis or midrib lengthening after the expansion has ceased to grow, splits it into ribands in the direction of the secondary fibres at right angles with the midrib [§ 1206], which only differ in their direction from the lacerated portions of the flabelliform palms, in which the axis of the leaf may be considered abortive, and the ribands of the expansion exserted from the same point. Even in the direction of the lacerations they are identical with the Sago and the Date. In *Strelitzia* the foliar expansion is occasionally suppressed.

(1259.) The *Musaceæ* are spathaceous, as are likewise the majority of the palms; but they differ from them and most of the preceding sections in having the ovarium inferior and the tube of the calyx adherent to the germen, the flower of course being superior. The perigone is petaloid and often of the most brilliant colours, of three external and three internal pieces, which, although both coloured, differ like Iris in the degree of their development; the stamens are six in number, either all fertile, or the anther of one or more abortive, and the filaments surmounted with a petaloid appendage. In *Musa*, the normal genus, five of the segments of the perigone are external, forming an upper lip, and one only internal, which is the lower lip. The anthers are linear, introrse, and bilocular, dehiscing longitudinally. The germen three-celled, and the seeds with the embryo in the axis of a farinaceous albumen.

(1260.) *Musa, Urania, Heliconia,* and *Strelitzia,* are all most splendid plants, the leaf-formed stems varying from five or ten, to five and twenty, or thirty feet in height, and the leaves being each from two or three, to ten or twelve feet in length. In *Urania* [§ 1206] the leaves are disposed in a graceful fan-like spread, and those both of Musa and Strelitzia are even in our conservatories quite magnificent.

Strelitzia regina. Flowers arising from within a common spatha. A. Flower denuded of calyx. B. An entire flower, shewing stamens, pistil, and nectary; *f*, germen; *g*, corolla; *h*, nectary; *i*, stamens; *k*, pistil. C. Front view of a flower. D. Back view of ditto.

(1261.) The two most valuable and best known species of *Musa* are the Adam's apple or Plantain (*M. paradisaica*), and the Banana-plantain (*M. sapientum;*) the latter is a denizen of the New, the former of the Old World. Indeed, as the specific name *paradisiaca* imports, a notion was entertained by

the old botanists, as by Gerarde and others, that this was the forbidden fruit of Eden ; while others, having regard to the immense grape-like clusters in which its fruit is collected, have supposed it to be the so-called grapes,—one bunch of which was borne upon a staff between two men—that the spies of Moses brought out of the Promised Land. It is not however at all likely, other considerations apart, that a plant so useful should have been the forbidden fruit. The Plantains and Bananas are well esteemed among the most valuable gifts bestowed upon the inhabitants of the hotter regions of the globe, and they have followed the footsteps of man to all countries where he has dwelt, in which the climate would suffer their growth.

Europeans who settle in America, and families as they separate and establish themselves by marriage as a first step toward their support, plant a Banana walk, which they extend as their family increases. Some of the Plantains are in bearing in turns during the whole year, and their fruit is often the whole, or the chief part of the food, on which the family subsists. Three dozen fruits are sufficient to serve one man a whole week instead of bread, and will support him in warm countries much better. When boiled or roasted, they are used in the place of bread, and eaten with fish or salt meat. When ripe, tarts are made of them, or the fruit is sliced and fried with butter, or dried and preserved as a sweetmeat, or converted into an excellent marmalade. An intoxicating liquor is also made from them by fermentation; and this drink, when procured from the M. sapientum, is, says Loudon, like our best Southam cider. The young shoots are eaten as a delicate vegetable.

(1262.) The fruits of some species of *Heliconia* and *Urania* are also eatable, as the *U. speciosa* and *H. psittacorum*, but they are not in such general estimation as those of the Bananas. The juice of the fruit of *Urania* is used for dying, and that of the fruit and stem of *Musa* is said to be astringent and diaphoretic. The leaf-formed stems are remarkable for the profusion of spiral vessels they contain, which may be pulled out by handfuls, and are used in the West Indies as tinder. *Musa textilis* affords a very valuable flax-like fibre, from which some of the finest Indian muslins are made. The leaves of all the species are likewise employed in the manufacture of baskets, matting, mattresses, thatching, and for numerous other similar purposes. The native Indians use them also as plates, dishes, and napkins; and those persons who believe the fruit to be the forbidden apple of Paradise, have also adventured the groundless surmise that the large leaves of plantain were the so-called fig-leaves of which our first parents made their aprons.

(1263.) Differentially considered, the *Musaceæ* are spathaceous *Scitamineæ*, with a hexapetaloid perianth, and more than three fertile stamens.

(1264.) Zingiberaceæ. *Zingiber*, [§ 1254, c, d] and its allies, *Amomum*, *Costus*, *Alpinia*, *Curcuma*, *Kæmpferia*, &c. form, collectively, the type *Zingiberaceæ*; of which the tripetaloid perianth and single median fertile stamen, with a two-celled anther, and the embryo surrounded by the vitellus, are the chief differential signs. Almost the whole of the Zingiberaceæ are aromatic plants; the

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tuberous roots or root-stakes abounding in spicy juices; and the seeds of many are aromatic also.

(1265.) In the *Zingiberaceæ* the leaves are simple with longitudinal linear veins, like those of the Musaceæ, but more obliquely penninerved; the petioles still clasp the bases of each other, and form a sort of culm similar to the *Bananas*, and, like them, the true stem or stipes in this section is prostrate or subterranean, and is often called the root, as in *ginger*. The leaf-sheaths are cleft, and sometimes furnished with a ligule; the inflorescence is in spikes or racemes, rarely solitary, with spathaceous bracteæ; the perigonium is in two rows, the inner more developed than the outer, and petaloid, with one segment often larger than the others. The corolla is tubular and irregular, and within it are three petal-like productions, forming a nectary, which are equivalent to those of the six stamens of Musaceæ, degenerating into petals; one segment of the nectary is larger than the rest, and lip-like, the lateral pieces being often almost or altogether abortive. Within the nectary are three stamina, one only of which is perfect, with a two-celled anther; the others are on each side abortive, assuming the appearance of glands, and sometimes connate. The pollen is light, granular, globose, and smooth. The germen three-celled (rarely one-celled,) style filiform, stigma hollow and dilated. The fruit is capsular, rarely sub-baccate, and trilocular. The seeds roundish or regularly angled, and sometimes arillate, and containing a cylindrical embryo surrounded by a *vitellus*, and enclosed in a farinaceous albumen.

(1266.) *Amomum*, the genus in which most of the aromatic Scitaminæ were formerly included, and from which the present type is sometimes called the *Amomeæ*, has been very much reduced in extent since the reformation of the order effected by Roscoe. Ginger and Cardamom now belong to other genera, and the *Grana Paradisi* is almost the only species that justifies the retention of the generic name Amomum (*α μωμος*), *anticorruptive* or *counter-poison*, these plants having been once considered preventives of putrefaction and antidotes to poisons.

(1267.) The grains of Paradise are stomachic and stimulant, but far less grateful as a spice than either cardamoms or ginger; they are often, however, substituted for the former, and have even been called the 'greater Cardamom.'

(1268.) The officinal Cardamom is the fruit of the *Alpinia cardamomum ;* and it is much valued as a condiment in warm countries. Here the seeds are chiefly used as medicines, and in dyspectic cases render considerable service. The *Galangales* (Kæmpferiæ), the *Zedoaries* (Cucuma Zedoaria and Zerumbet), are also esteemed as spices, and several others, such as *Curcuma longa* (or Turmeric), which is also aromatic, afford excellent dyes. *Turmeric* is one of the constant ingredients with ginger, cardamoms, and the like associated spices, in the celebrated curry-powders of the East and West Indies.

(1269. The rhizomata of all the Zingiberaceæ contain fæcula, which, however, is rendered unfit for ordinary food, and can only be used as a condiment by the quantity of pungent, resinous, and aromatic oily matter it contains; in some, however, as Curcuma angustifolia, the spicy flavour is lessened, and from it an excellent kind of arrow-root is prepared.

(1270.) MARANTACEÆ. *Maranta*, and its allies, *Thalia*, *Myrosma*, *Phrynium*, *Calathea*, and *Canna*, [§ 1254, A, B.] con-

stitute a type called, indifferently, MARANTACEÆ or Canneæ, which is differentially characterized by having the stamina reduced to one, the others being petaloid, and this single fertile stamen being lateral and having a dimidiate or one-celled anther, seeds exarillate, and the embryo not enclosed in a sac, the vitellus being absent.

Canna flaccida. (*a*) Cutting, to shew penninerved, or pennicostate leaf, and flower.

(*b*) Ovary with the adherent calyx.

(*c*) Corolla open, shewing the one-celled anther.

(*d*) The fruit.

(*e*) Transverse section of ditto, to shew the three cells.

(*f*) A seed, shewing the opercle and the embryo.

(*g*) Section of ditto, to shew the embryo.

(*h*) The embryo enlarged, to shew the coleorhize and radicle.

(*i*) The seed germinating.

1, The testa, including the nucleus; 2, the raised operculum; 3, base of the cotyledon; 4, the præmorse radicle; 5, the primordial leaf.

(1271.) The Marantaceæ are scentless, insipid plants, the pungent aromatic principle being wanting in them which is so peculiarly characteristic of the Gingers and their allies. Hence the fecula which is abundant in their roots is collected and prepared as food, and, from its former use as a cataplasm for arrow-wounds, it is commonly known under the name of arrow-root. This farinaceous substance is procured from many different species, but chiefly from Maranta arundinacea in the West, M. Allouya and ramossima in the East Indies; the tubers of M. Allouya are also eaten entire when roasted, and the rhizomata of several Cannæ are used as food in Peru. Baskets are likewise made from their leaves, and the tough fibres they contain are applied to various domestic purposes.

(1272.) The Marantaceæ have frequently been confounded with the Zingiberaceæ, and they are in many respects closely allied to them, but still they are clearly distinguished by having their single anther one-celled, the other cell having degenerated into a petaloid production of the filament, and the stamen lateral. The style also is not threadshaped, but either tumid or petaloid, and in the seeds the vitellus is abortive, so that the embryo is covered only by the perisperm or albumen. This series of natural metamorphoses, in which the six stamina of Musaceæ pass from five to one in Zingiberaceæ, and that one losing one cell of its anther in Marantaceæ, and varying as they do as to which stamens are abortive, in Zingiberaceæ the central one being fertile, and in Marantaceæ

one of the side stamens being that which bears half an anther, leads the student to the contemplation of another very curious and natural series, contingent with these, but in the following section, viz. the orchideous plants, in which the changes are still more extraordinary than in the SCITAMINÆ.

ORCHIDINÆ.

(1273.) The plants associated with *Orchis* in the section called from it [Orchideæ or] *Orchidinæ*, exhibit some of the most curiously interesting modifications of structure that any groups in the vegetable world afford; and hence several of these transformed organs have received peculiar appellations.

(1274.) The Orchidinæ are chiefly perennial and herbaceous plants, some few only being suffrutescent, and in many the stem is obsolete; but to the crown of the root one, two, or more fleshy tubers are attached, [§ 3, *b*, *e*, *h*,) which contain the buds that are to form the plants of the succeeding year; in others the tubers are fascicled; and in others again, as the Aerides, or air-plants, the above-ground stem is enlarged and succulent, and the roots tortuous, caulescent, and of a green hue: many of them are epiphytic, as the Epidendra and Vanillæ.

The leaves of the whole section are simple and entire, alternate, either sheathing or articulated, with nervo-striated venation, and occasionally degenerating into scales.

(1275.) The perigonium consists of six pieces, mostly petaloid, and arranged in two series, [§ 3, *a*, *d*, *g*;] the sepals of the calyx are in general similar to each other, the odd one being uppermost; the petals of the corolla vary in form; the upper petal, which by the twisting of the ovarium becomes apparently the lower, is called the *lip* (labellum), as the two lower sepals, which become from the same cause uppermost, are named the *helmet* (galea). The lip, or labellum, which is often lobed, and assumes a great variety of grotesque forms, likened to flies, bees, men, and monkeys, [§ 3, *c*, *f*, *g*, *h*, *i*,] has been called by some persons the nectary. The stamina are three in number, becoming by abortion two or one, and, united with the pistil, forming a fleshy column, called the *gynosteme*, which surmounts the ovary; and hence these plants have been termed *epigynous* by Jussieu, and *gynandrous* by Linnæus. On the apex of the gynosteme there is found, in the Orchidaceæ, a two-celled anther, and on either side an eminence *(staminodia,)* marking the abortion of the other two, which remain in a rudimentary state in all the type, named, from *Orchis*, the ORCHIDACEÆ, and which are placed by Linnæus in his order Monandria of the twentieth class.

(1276.) In *Cypripedium*, or the lady's slipper, the stamens, which are abortive, as *Staminodia* in the Orchidaceæ, become developed, and the centre anther remains abortive as a staminodium, which circumstance characterises the second type, called, from the only genus it contains, the CYPRIPEDIACEÆ.

This curious plant will be found in Gynandria Diandria of the Linnæan artificial scheme.

(1277.) Before the single anther in Orchideaceæ, and rather before and between the two anthers in Cypripediaceæ, there is a secreting cavity, which is the naked stigma of the pistil, the other part of which is blended with the stamens in the

gynosteme. The pollen contained in the anthers is sometimes pulverulent and free, but more frequently waxy or granular, with the grains cohering in masses, which are called *sectile* masses: these have often prolongations, called *candiculæ*, by which they are attached to a viscid gland, that has been named the *retinaculum*.

(1278.) Occasionally the Staminodia betray their metamorphosis, and become fully developed as stamens; an instance of which has been mentioned by Achille Richard, as having been observed in *Orchis latifolia;* and others are noticed by Brown, in his essay on those plants published in the Transactions of the Linnæan Society.

This phenomenon, casual in the Orchides, appears to be the permanent and normal state in a genus allied to the Orchidaceæ, and named by Blume *Apostasia;* for in it the three stamens are developed, and the anthers free, one being barren.

(1279.) This very interesting genus, figures of two species of which have been published by Dr. Wallich, in his "Plantæ Asiaticæ Rariores," establishes the connexion between this section and the contingent ones in a manner the most satisfactory and unexpected. But although, without doubt, Apostasia belongs to the section Orchidinæ, it cannot be included in either of the established types, and must therefore be considered the normal genus of another, which may be called Apostasiaceæ.

The fruit in the Orchidinæ is capsular, rarely baccate, the placentæ parietal; seeds small and many; the testæ lax, reticulated, and membranaceous, with embryo minute, and not distinct from the albumen.

(1280.) Their reversed gynandrous flowers, inferior ovaria, and usually coherent pollen, will sufficiently distinguish the *Orchidinæ* from every other section, and furnish excellent differential characters.

(1281.) The three types are distinguished among themselves by the first, the Orchidaceæ, having the flowers monandrous, and the germen unilocular.

(1282.) In the second, the Cypripediaceæ, the flowers are diandrous, and the germen still one-celled.

(1283.) While in the third, the Apostasiaceæ, the flowers are diandrous or triandrous, the anthers discrete, and the germen trilocular.

(1284.) Apostasiaceæ. Three species of *Apostasia* are all that have been as yet discovered, and these are plants the properties and uses of which are very little known. Their chief interest depends upon the structural gradations they exhibit, by which the Orchidaceæ and Cypripediaceæ become associated with the Iridaceæ, Zingiberaceæ, and Musaceæ of the contingent sections. Thus, in *Musaceæ* the stamens, and in *Iris* the pistils, are petaloid; in

Zingiberaceæ the stamens are reduced to one, and in *Marantaceæ* even the single stamen has only a one-celled anther. Thus also in *Apostasia*, in which three stamina, the normal number in the *Orchidinæ*, are alone developed, the anther is absent from one

A. *Apostasia Wallichii.* (*a*) Entire plant, shewing its caulescent roots, alternate sheathing, nervo-striated leaves, and flowers. (*b*) A flower separated. (*c*) The same dissected, to shew the six pieces of the regular petaloid perianth, the style and stamens. (*d*) The style and stamina denuded. (*e*) An entire flower, fully expanded in order to exhibit the internal parts *in situ.* (*f*) The capsule, nearly ripe, divided transversely to shew the three cells. (*g*) A stamen detached. (*h*) Pollen. (*i*) Style, with the barren stamen reflected to shew the indications of the two cells of the abortive anther. (*j*) Seeds; one being divided longitudinally, the other entire.

B. *Apostasia nuda.* (*a*) Entire flower, shewing the hexapetaloid, regular perianth, inferior germen, stamen, and pistil. (*b*) Stamen detached. (*c*) Pollen. (*d*, *e*) Different views of the style, with corresponding plans, shewing the relative position of the parts of the flower.

C. *Ophrys apifera*, side view, to shew the single fertile stamen, two staminodia, and (*a*) a sectile mass of pollen with its *caudicula.*

filament, as in *A. Wallichii;* while in *A. nuda* the barren stamen is altogether wanting. In *Cypripedium* two stamens only are fertile, one being abortive; and in *Orchidaceæ* two are abortive, one alone bearing a fertile anther.

(1285.) CYPRIPEDIACEÆ. *Cypripedium Calceolus* is one of the rarer British plants, and the most beautiful of the European

Orchidinæ; it is innoxious, and slightly nutrient. A decoction of its roots has been commended by Gmelin in cases of epilepsy, but their influence in that disease is more than apocryphal.

Cypripedium flavescens.

B. Entire plant, shewing fibrous root, amplexicaul leaves and flower.

(*a*) Front view.

(*b*) Side view of the stamens and pistil.

(*c*, *c*) Well-developed lateral stamens.

(*d*, *d*) Terminal or third stamen, abortive.

(*e*, *e*) Stigma.

(1286.) ORCHIDACEÆ. *Orchis*, and its allies, are associated, by their monandrous flowers and unilocular ovaria, to form this type, which, from the normal genus, is called the Orchidaceæ. It contains the bulk of the orchidinous plants, the other two groups being each formed of only a single genus.

(1287.) The genera included among the Orchidaceæ being many, it has been found advisable to distribute them into several subtypes, distinguished by the different states of the pollen.

(1288.) In *Limodorum*, *Epipactis*, *Pogonia*, *Goodyera*, &c., which form the Limodoridæ, the pollen is pulverulent and simple, or formed of a kind of pultaceous matter in a lax state of cohesion.

(1289.) In *Orchis*, *Ophrys*, *Satyrium*, *Serapias*, *Habenaria*, *Vanilla*, &c., which form the subtype Ophrydæ, the pollen is in sectile masses or coherent granules, which finally become waxy, and are indefinite in number.

(1290.) In *Malaxis*, *Epidendrum*, *Vanda*, and others, which form the Malaxidæ, the pollen is in coherent grains, definite in number, and becoming waxy, and often being solid.

(1291.) The Orchidaceæ are more prized for their beauty and the strangeness of their flowers, than for any very important dietetic or medicinal properties they possess. When the doctrine of signatures prevailed, their geminate roots were supposed to be powerful aphrodisiacs, and hence the names Orchis, Satyrium, Serapias, &c. have been given to various genera; but it is probable that no quantity would induce that kind of madness which characterised the Roman demigods, or the devotees of the more profligate Egyptian divinity.

(1292.) The tubers of these plants contain a great deal of very nutritious farinaceous matter, consisting, according to modern chemical analysis, of a proximate principle called Bassorine. This substance is known commonly as *saloop*, or *salep;* a word derived from the Persian name of the Orchis, which, according to Forskhall, is *Sahleb.* It used to be sold at the corners of the streets in London, and was a favourite drink with porters, coalheavers, and other hardworking people; and it is still highly esteemed both in Turkey and in Persia. It is said to contain more nutritious matter in proportion to its bulk than any other known substance, and that an ounce a-day will be sufficient to sustain a man: hence it is a favourite food, from its portability, with pedestrian travellers in wild deserts and uninhabited countries.

(1293.) Some of the South American species, such as the *Cataseta* and *Cyrtipodia,* contain a viscid substance, which, when separated by boiling and inspissated, is used by the Brazilians instead of glue. The root of *Bletia verecunda* is said to be stomachic, and *Orchis abortiva,* and others, slightly astringent.

(1294.) *Vanilla* is the produce of the *V. aromatica,* the old Epidendrum Vanilla. This plant is a climbing epiphyte, growing in the West Indies, and its root is used for flavouring chocolate, and also for perfuming snuff.

(1295.) The *Epidendra, Aerides,* and many others of the epiphytic species, (for they are not truly parasites,) are familiarly known as air-plants. They absorb much of their food from the atmosphere, and hence require very little either soil or water; so that, when taken from the trees on which they grow, just before their flowers are developed, and suspended by strings from the ceiling of a room, they will live for weeks, and even months, supported solely by the moisture floating in the atmosphere, and go on blossoming luxuriantly: hence they are some of the most favorite and elegant ornaments of the houses in China and Japan.

(1296.) Dr. Brown's observations on the structure of *Apostasia,* its relation to the *Orchideæ,* and the connexion it establishes between this section and the *Scitamineæ,* bear the impress of so much physiological research, and so fully corroborate the views above given of the affinities of these plants, that their history would be incomplete, were his remarks omitted: they are therefore quoted almost entire from his MS. notes, as published in Wallich's Plantæ Asiaticæ Rariores.

"This very remarkable genus, founded on Apostasia Odorata, was first published in 1825, by Dr. Blume; but in 1821 a nearly related species was discovered in the valley of Noakote, in Nepal, by the plant collectors of Dr. Wallich, who, in his MS., which I have had the advantage of consulting, named it *Mesodactylis deflexa.*

"I have followed these two distinguished botanists in regarding Apostasia as belonging to, or at least as most nearly related to, Orchideæ. It exhibits, however, very few of those characters generally considered as essential to that family of plants. In its antheræ, pollen, style, and stigma, (all which parts are so remarkably modified in *Orchideæ,)* Apostasia does not materially differ, either in form, structure, or economy, from the more regularly flowered families of monocotyledons; and in its trilocular ovarium it is distinguished from all other genera of the order to which it has been appended.

"On the other hand, it agrees with Orchideæ in the structure, as far as I am able to ascertain, of its minute seeds; in the reduced number of stamina, and probably with some genera of the family in the order of their reduction; in the filaments being at the base connate with the lower part of the style; and in a great degree in habit. In endeavouring to estimate the importance of the several points of resemblance and difference here enumerated, with a view to decide on the degree of relationship Apostasia bears to Orchideæ, it is necessary to consider the relative position of the parts of the flower in that order, and also in Scitamineæ (Zingiberaceæ), the family most nearly allied to it.

"The relation of the stamina to the parts of the floral envelop in Apostasia is in the first place to be determined. The two antheriferous filaments which I have more particularly examined in the unexpanded flowers of Apostasia nuda appear to be opposite to the two lateral segments of the inner series of the perianthium; and the sterile filament in Apostasia Wallichii, and no doubt in A. odorata, is opposite to the interior segment of its outer series.

"Several years since I advanced the opinion, that in a complete flower, whose parts are definite, the number of stamina, and also of pistilla, is equal to that of the calyx and corolla united in dicotyledons, and of both series of the perianth in monocotyledons." *(App. to Denham's Travels.)*

It may further be observed that, in cases of reduction of pistilla, it is generally found that the remaining carpella, when more than one, but inferior in number to that of one series of the floral envelop, correspond in position with parts of both series, and, with very few exceptions, whether distinct or confluent, are all equally developed: stamina on the other hand, in cases of equal reduction, generally belong to one series only; or, if corresponding with parts of both series, are usually in different states of development, as they are here described to be in two species of Apostasia.

This appearance of part of the inner series of stamina has not hitherto been expressly remarked in *Orchideæ*. It is not improbable, however, that the same relation to perianthium exists in the lateral antheriferous stamina of *Cypripedium*, as well as in the sterile petaloid processes similarly situated in other genera, as in Diuris; and the third stamen of the inner series, still more altered in form, may be considered as present in certain New Holland genera, especially Glossodia, where this supposed stamen is placed within the labellum, but entirely distinct from it, in Epiblema, Pterostylis, and Chiloglottis, in which an analogous appendage, similarly situated, coheres in various degrees with that division of the perianthium; and perhaps it may be considered as indicated in all cases in which the labellum is furnished with a process, however minute, arising from its axis.

If the view here taken of the position of the lateral filaments in Cypripedium and Diuris be adopted, it may be remarked that indications of the two stamina

necessary to complete the number in Orchideæ, of those, namely, corresponding with the lateral segments of the outer series of the perianthium, have not been yet observed in the regular structure of any plant of the order. They have, however, been occasionally met with in the monstrous flowers of Habenaria bifolia: in more than one spike of which, I have found the greater number of flowers triandrous, the three anthers being equidistant, and placed exactly opposite to the three divisions of the outer series of the perianthium, the inner series of which remains in its ordinary state.

In Scitamineæ, the family most nearly akin to Orchideæ, the complete number of stamina may be considered very generally present: only one, however, is antheriferous; and this perfect stamen, instead of corresponding, as in Orchideæ, with the anterior segment of the outer series of the perianthium, is placed within the posterior segment of the inner series; the two remaining barren stamina of the same series being the epigynous glands, or filaments, existing in all the genera of this order except Costus; while the outer series of stamina, very differently modified, form the innermost or supplementary series of the perianthium.

Apostasia, in its trilocular ovarium, differs from all the genera of Orchideæ; but an analogous difference occurs in Scitamineæ, in which Globba is distinguished from every other genus, in having its ovarium unilocular, with three parietal placentæ; and in both these families it may be proved that the constituent parts of the compound ovarium, whether unilocular or trilocular, agree in position, or in their relation, to the divisions of the perianthium.

Lastly, Apostasia, in the state of the pollen, and its manner of application to the stigma, probably differs essentially from all Orchideæ, except perhaps Cypripedium, and possibly *Vanilla*.

HYDROCHARINÆ.

(1297.) The lily-frog-bit (*Hydrocharis*), and the water-soldier (*Stratiotes*), with the beautiful and interesting *Vallisneria*, form, collectively, a section called, from the normal genus, *Hydrocharis*, Hydrocharinæ. These plants are connected with the *Alisminæ* and *Nayadinæ* in several points, as their exalbuminous seeds, semipetaloid perianths, and watery habitats declare; they are however sufficiently distinguished from these, and all other sections of the orders *Juncales* and *Liliales*, by their inferior ovaries and superior flowers, by which they are associated with the MUSALES.

(1298.) The *Hydrocharinæ* are aquatic herbs, or herbaceous plants, with the stems usually abortive, and the leaves for the most part radical, sometimes crowded, at others remote, alternate, or verticillate; the expansion, when present, floating, but the foliage often degenerates into phyllodia, occasionally furnished with spinacules and sheathing. The flowers are spathaceous, and usually separate; the perianth developed in two series, forming calyx and corolla; stamens three, six, or more, with filaments free; germen inferior, and single stigma divided (rarely simple;) fruit dry or succulent, inde-

hiscent, one or more celled, and many-seeded; seeds erect and exalbuminous, testa membranaceous, embryo straight, radicle inferior, and plumula inconspicuous.

(1299.) Hence it will appear that, differentially considered, the *Hydrocharinæ* are aquatic tripetaloid Musales, with free stamina and exalbuminous seeds.

(1300.) The genera included in this section, although agreeing in the above characters, common to them all, and by which they are as much separated from contingent groups as allied to one another, have been very properly, on account of several peculiarities of structure, distributed by Link into three subsectional groups, or types, named respectively from the normal genera *Stratiotes, Hydrocharis*, and *Vallisneria*, the *Stratiotaceæ, Hydrocharaceæ*, and *Vallisneriaceæ*.

(1301.) The *Stratiotaceæ* have the flowers spathaceous, the calyx tubular, and the petals of the corolla discrete both in the stamineous and pistilline flowers; the fruit also is baccate (not capsular), and the leaves are sheathing and with a parallel venation.

(1302.) The *Hydrocharaceæ* are distinguished from both their compeers by the veins of the leaves, which in them are linear and unconnected, having here the parallel venation from base to apex traversed by lateral veins passing from one series to another. The pieces of the corollæ are also discrete, the calyx cleft to the base, and the fruit a leathery capsule, not a berry. (§ 1305.)

(1303.) The *Vallisneriaceæ* are known by the diclinious (often diœcious) flowers; the stamineous ones having the corolla synpetalous, while in the pistilline flowers the petals are discrete. The fruit is also a one-celled many-seeded capsule, with parietal placentæ. (§ 1306.)

(1304.) Stratiotaceæ. *Stratiotes*, which has been so named from its sword-shaped leaves and the fanciful military appearance of the plant, is a very ornamental aquatic. It remains submerged during the greater part of the year, but raises itself to the surface on special stalks during the season for fertilizing the seeds; a device of nature to meet and overcome difficulties, which is still more curiously exemplified in one of the following types. The foliage of Stratiotes is very similar to that of Bromelia, but the leaves in the latter are scaly, while those of the former are smooth.

(1305.) Hydrocharaceæ. *Hydrocharis Morsus Ranæ*, or the frog-bit, is the lesser water-lily of the old writers, and is still con-

sidered by Richard and others to be an associate of the *Nymphæaceæ*, but the relation is one of analogy rather than of affinity; these being monocotyledonous endogenæ, while the weight of evidence declares that the *Nymphæaceæ* are exogenous dicotyledons.

Hydrocharis is a highly ornamental water-plant, which will grow

Hydrocharis Morsus Ranæ.

A. Entire plant. (*a*) Stamineous flower. (*b*) Ditto, with two stamens only left. (*c*) Stamen detached. (*d*) Female flower. (*e*) Longitudinal section of ditto. (*f*) Fruit. (*g*) Transverse section. (*h*) Seed. (*i*) Nucleus cut lengthwise. (*j*) Ditto, a transverse section.

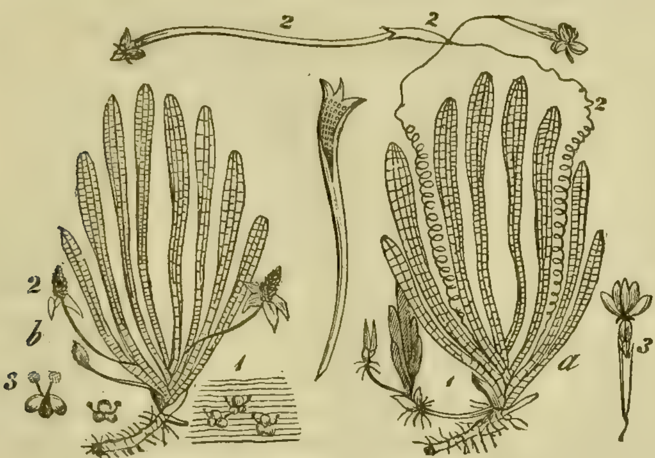
freely in ponds and ditches, and deserves to be more frequently introduced into aquaria.

(1306.) VALLISNERIACEÆ. Besides the differential characters of the type, the Vallisneriæ have the pistilline flowers elevated on spiral peduncles or footstalks; a structure almost peculiar to these plants, and to them of extreme importance.

The *Vallisneriæ*, unlike Hydrocharis and Stratiotes, which prefer still waters, delight to grow in rivers and rapid streams, where the level often varies one or two feet or more within the space of four-and-twenty hours. Now it is essential to the well-being of the plants, and to enable the ovules to be fertilized and the seeds to be ripened, that the flowers should, during the period of maturity, be kept on the surface of the water, and secured from frequent submersion. It so happens, from the peculiar structure of these plants, the stamens being distinct from the pistils, and even on separate roots, that the fertilization of the ovules is, as usual in such cases, difficult; and in this instance the difficulty of transferring the pollen from the anthers to the pistil is almost insuperably increased, by the stamineous flowers [*b*, 2] growing on short stalks below the water, while the pistilline ones [*a*, 2] are carried up by their specific levity and spiral peduncles to the surface. But these difficulties would seem to have been made only for the purpose of shewing with what admirable ingenuity they can be overcome. A particular example may be cited as an illustration: the Vallisneria spiralis grows in vast abundance in the Rhone, which is a river of very uncertain

depth, and that in places very near one another. The plants, during their propagation by runners or seeds, have therefore very different distances to pass

Vallisneria spiralis.



(*a*) Pistilline plant; 1, offsets; 2, pistilline flowers floating on the water supported by their spiral peduncles; 3, a flower separate. (*b*) Stamineous plant; 1, ditto flowers floating on the surface of the water; 2, ditto, attached to plant; 3, ditto opened, to shew the stamens.

through before they reach the surface of the water. But this is not all: the Rhone is also of all rivers the most apt to be swollen by sudden floods; and how is a plant flowering at the surface in four feet of water to avoid being submerged when the depth is suddenly increased to six feet? The spiral peduncles of the pistilline flowers are the mechanical means by which this object is effected, for as they gradually contract like a helix or wire-spring when the water falls, so on the other hand they are readily extended when it rises. But the pistilline flowers alone have spiral peduncles: the stamineous ones are seated on short stalks near the roots of the plants, and at four or six feet below the surface of the water. When, however, the pollen is ripe and fit to fertilize the ovules, the stamineous flowers detach themselves, and rising by their lightness to the surface of the water, their petals, by which the stamens are protected, open by the influence of the sun, and the stamineous flowers mingling with the pistilline ones already elevated on their spiral peduncles, the pollen is easily shed from the one upon the other, and the seeds are fertilized. It is added, that when the seeds are ripened the spiral peduncle again contracts, as it does in *Cyclamen*, and carrying down the capsule buries the seeds in the mud.

(1307.) None of the *Hydrocharinæ* are noxious plants, and very few have been applied, or appear to be applicable, to any useful purposes. The Hydrilla (the *Vallisneria alternifolia* of Roxburgh,) is the Janji of Hindoostan, and is one of the plants employed to supply water mechanically to sugar during the process of refining. The fruit of Enhalus is edible, and it affords a fibre which, according to Agardh, is capable of being woven into various fabrics.

(1308.) The *Vallisneriaceæ* form the last type in the section *Hydrocharinæ*, and the *Hydrocharinæ* the last section in the order Musales, with which order the class Palmares ends. It therefore

only now remains to give the usual tabular conspectus of the various types and sections included in the several orders, with references to their respective definitions.

- PALMARES (1075)
  - MUSALES (1206)
    - HYDROCHARINÆ (1297)
      - *Vallisneriaceæ* (1303)
      - *Hydrocharaceæ* (1302)
      - *Stratiotaceæ* (1301)
    - ORCHIDINÆ (1273)
      - *Orchidaceæ* (1281)
      - *Cypripediaceæ* (1282)
      - *Apostasiaceæ* (1283)
    - SCITAMINÆ (1254)
      - *Marantaceæ* (1270)
      - *Zingiberaceæ* (1264)
      - *Musaceæ* (1263)
    - NARCISSINÆ (1219)
      - *Iridaceæ* (1153)
        - *Ferraridæ* (1251)
        - *Crocidæ* (1251)
      - *Burmanniaceæ* (1241)
        - *Burmannidæ* (1244)
        - *Hæmadoridæ* (1243)
      - *Amaryllaceæ* (1238)
        - *Amaryllidæ* (1237)
        - *Hypoxidæ* (1237)
      - *Bromeliaceæ* (1222)
        - *Bromelidæ* (1227)
        - *Tillandsidæ* (1224)
    - TACCINÆ (1208)
      - *Dioscoraceæ* (1114)
      - *Taccaceæ* (1211)
  - LILIALES (1146)
    - LILIACINÆ (1166)
      - *Smilaceæ* (1203, 1172)
        - *Smilacidæ* (1203)
        - *Parisidæ*
      - *Colchicaceæ* (1200, 1171)
      - *Liliaceæ* (1194, 1170)
      - *Asphodelaceæ* (1176, 1169)
        - *Aloïdæ* (1188)
        - *Scillidæ* (1181)
        - *Gilliesidæ* (1179)
      - *Pontederiaceæ* (1168)
    - ALISMINÆ (1157)
      - *Butomaceæ* (1162)
      - *Alismaceæ* (1158)
    - EPHEMERINÆ (1149)
      - *Ephemeraceæ* (1154)
      - *Xyridaceæ* (1153)
      - *Aphyllanthaceæ* (1151)
  - JUNCALES (1100)
    - JUNCINÆ (1136)
      - *Juncaceæ* (1139)
      - *Restiaceæ* (1138)
        - *Eriocaulidæ*
        - *Restionidæ*
        - *Centrolepidæ*
    - NAYADINÆ (1128)
      - *Juncaginaceæ* (1133)
      - *Podostemaceæ* (1131)
      - *Nayadaceæ* (1128)
    - ACORINÆ (1116)
      - *Lemnaceæ* (1125)
      - *Callaceæ* (1121)
      - *Orontiaceæ* (1117)
    - TYPHINÆ (1103)
      - *Typhaceæ* (1109)
      - *Pandanaceæ* (1104)
        - *Pandanidæ* (1104)
        - *Cyclanthidæ*
  - PALMALES (1085)
    - PHŒNICINÆ
      - *Arecaceæ* (1097)
        - *Cocöidæ* (1097)
        - *Arecidæ*
      - *Phœnicaceæ* (1088)
        - *Sabalidæ* (1094)
        - *Coryphidæ*
        - *Borassidæ* (1093)
        - *Calamidæ* (1089).

GEOGRAPHICAL DISTRIBUTION OF THE PALMARES.

(1309.) This, the only other class which can vie with the preceding in importance, as affording food for animals and man, is, like it, most extensively distributed over the surface of the earth; some representatives being found in every latitude, from the equator nearly to the poles. But, though some of the numerous genera and species are thus found to prevail in nearly every region, they are not all cosmopolites; a few sections, genera, and species, are present almost everywhere, but the range of the majority is confined within certain limits, of greater or less extent in different instances, and some are absolutely local. This will be evident from the following conspective summary of the topographical distribution of the various types and sections included in the four orders of this class, which, as it will afford materials for the more general survey, may advantageously precede the account of the vegetable statistics of the zones and regions.

(1310.) The Palms, which, from their size and peculiar port, form such a characteristic feature in the vegetation of warm countries, are chiefly intertropical plants; very few are even found in the southern parts of the temperate zones, and none in their northern regions. From 35° to 38° is their utmost range from the equator in the southern hemisphere, and from 40° to 43° or 44° in the northern. In the New World, one species, *Chamærops palmetto*, alone reaches so far north as 36°; but, in the Old World, *Chamærops humilis*, the only European palm, is found near Nice, in latitude 43°-44°; and the contrary extreme on the other side of the equator is in New Zealand, in latitude 38° south. But, as Martius observes, even this confined geographical range is not fully enjoyed by all. Most of the palms are so exclusively local, that Humboldt and Bonpland lost some of the old, and discovered new species, in almost every fifty miles of their journies through the vast forest regions of tropical America. The cocoa is one of the most widely spread of the palms: *Borassus flabelliformis* and *Acrocomia sclerocarpa* have also a comparatively extensive range. The equatorial regions of America appear to be peculiarly favourable to the growth and development of palms, as there they are found not only of the greatest size, but in by far the greatest numbers; for, of less than two hundred species now known, considerably more than half, indeed nearly two thirds, are South American. Asia is less prolific of these plants than America, Africa still less so than Asia, and Europe can scarcely boast the possession of a single species; the numbers being, for Europe, 1; Africa, 14; Southern Asia, 42 to 50; South America, 119 and upwards. In New Holland only three or four palms have been discovered; on the western coasts, even within the tropics, none have been found; and from South Africa they are wholly absent. The most important African species are the date, the doum, and the oil palms; in Congo and Guinea about six or eight species have been found, and as many are known in the Isles of France and Bourbon.

(1311.) The Juncales are more widely distributed than the palms: the arborescent ones being chiefly found within the tropics, or in warm latitudes; the herbaceous species in the cold or temperate regions. Thus while the *Typhaceæ* abound in the swamps and marshes of the northern and temperate zones, and are rare within the tropics, the *Pandanaceæ* are almost exclusively found in tropical islands, especially in those of the Indian Archipelago; and the large sandy plains in the Isle of France are covered with the curiously rooting *Screwpine*. The subtype *Pandanidæ* belongs to the Old World, the *Cyclanthidæ* to the New; but

the *Pandanaceæ*, on the whole, are comparatively scarce in the Western hemisphere.

(1312.) Again, of the Acorinæ, although the *Lemnaceæ* occur both in the equatorial and towards the polar regions, the Acorinæ, on the whole, are much the most abundant within the tropics, and gradually become fewer in the temperate zones; one only of the *Callaceæ*, viz. *Calla palustris*, reaches latitude 64° in Lapland; and although in warm countries they assume an arborescent port, in colder climates they are lowly herbaceous plants: their growth is most exuberant in the swamps of Hindostan.

(1313.) The Nayadinæ, as is the case with most water-plants, have a very extensive range. The Juncaginaceæ and Nayadaceæ are present by some of their representatives in every latitude even from Iceland to the line; they are, however, the most common in the cold and temperate regions, while the *Podostemaceæ* are most frequent in the torrid zone.

(1314.) Of the Juncinæ the two types are reversed in their distribution; the Restiaceæ being all, except *Eriocaulon*, extra-European and chiefly natives of warm countries, such as South America, Southern Africa, and New Holland, while the *Juncaceæ*, or true rushes, are rare in the equinoctial regions, but common in cold and damp situations in the temperate and frigid zones. Their proportion to other flowering plants has been calculated by Humboldt to be $\frac{1}{25}$ in the frigid zone; $\frac{1}{90}$ in the temperate; and only $\frac{1}{400}$ within the tropics.

(1315.) The Ephemerinæ are chiefly natives of warm countries; the Xyridaceæ being mostly tropical plants, and the *Ephemeraceæ* denizens of the East and West Indies, and Africa. A few occur in North America, as do some of the Xyridaceæ, but they are absent from the northern parts of Asia and Europe.

(1316.) The Alisminæ enjoy the usual privilege of aquatics, and occur in the equatorial as well as in the temperate regions, but they are most common in the colder latitudes of either hemisphere.

(1317.) The Liliacinæ exhibit a similar extensive range. A few, as the Pontederiaceæ, being found in the East Indies and in Tropical Africa, and North and South America, but the majority, as the Asphodelaceæ and Liliaceæ, in the temperate regions; the Smilaceæ and Colchicaceæ are very widely spread over all parts of the world, but their maximum, especially that of the latter, is towards the north.

(1318.) The Taccaceæ, and Dioscoraceæ, are almost exclusively tropical plants, natives of the eastern and western hemispheres. Tamus alone occurs in Europe.

(1319.) The Bromeliaceæ, although now naturalized in the Old World both in Africa and the East Indies, have migrated from the West Indies and the American Continent, to which they were originally peculiar, and where they still abound.

(1320.) The Amaryllaceæ are comparatively rare in the northern parts of the temperate zone; in the southern parts they increase in number and beauty; but it is in the East and West Indies, at the Cape of Good Hope, and especially in Tropical America, as in Brazil, that they reach their highest degree of relative proportion and the climax of their splendour.

(1321.) The Burmanniaceæ are also mostly tropical plants, the *Hæmodoridæ* abounding at the Cape of Good Hope and in Brazil; the *Burmannidæ* both in Asia and Africa, as well as America between the tropics.

(1322.) The Iridaceæ are more northern in their distribution than the pre-

ceding groups; in the equatorial regions comparatively few are known, their maximum being in the temperate parts of America and Europe.

(1323.) The SCITAMINÆ, on the contrary, are almost exclusively tropical plants, the MUSACEÆ flourishing only in hot countries, and hardly any of them, or of the ZINGIBERACEÆ or MARANTACEÆ, being found without the tropics.

(1324.) The ORCHIDINÆ are spread over all the moist and temperate regions of the globe. Extreme cold and dryness are however inimical to them, none being found within the frigid zone; and they are absent or nearly so from the sandy districts of Africa; but at the Cape of Good Hope they abound. In the East and West Indies, and other countries lying within the tropics, the epiphytic *Orchidaceæ* alone prevail; one only being known to reach so far north as South Carolina.

(1325.) The HYDROCHARINÆ are found in various parts of Europe, Asia, Australia, Africa, and America; the *Vallisneriaceæ* being rather the more southern, and the *Hydrocharaceæ* the more northern group. The Stratiotaceæ are about equal both within and without the tropics; their watery habitats equalizing the temperature, favors their wider geographical range.

(1326.) Thus it will appear that, although nearly universal in their distribution, the *Palmares*, like the previous classes, differ very greatly as to the groups which prevail in different regions, some of which are hence characteristic of the vegetation of certain latitudes, and others even of certain districts or localities, while very few enjoy an unfettered range.

Hence, statistically considered, the several geographical or rather botanical zones and regions possess each a flora peculiarly characteristic and more or less exclusively its own; a flora in which the presence or absence of certain groups of the Palmares, and their relative proportions to other plants, forms one of the most striking features.

(1327.) In the equinoctial zones extending to about 30° on either side of the equator, the arborescent Palmares, and especially the palms, if not exclusively found, occur in so much greater relative proportion, that they give that aspect to the landscape which has long been designated tropical. In these zones alone are found forests of columnar branchless trees, with all their leaves collected into terminal crowns, borne high into the air, and as vast as they are lofty. In these zones alone are seen herbs, or half herbaceous half arborescent plants, such as the Musaceæ, developing immediately from the soil leaves ten or fifteen feet in height by two feet in width, and attempting to form by their embracing leaf-stalks a spurious stem to vie with the pillar-like trunks of palms. Here almost alone are found the Ginger tribes, and those of the Cannæ and their allies. The *Pandanaceæ*, *Dioscoraceæ*, and *Taccaceæ*, are also peculiar to this zone, one only, viz. Tamus, being extratropical: to these must be added the epiphytic *Orchidaceæ*, the splendid *Aguves*, with the other *Bromeliaceæ;* and the *Burmannidæ*, the *Hæmodoridæ*, and the *Ephemeraceæ;* the *Restiaceæ* here supersede the *Rushes*, and the bulk of the *Amaryllaceæ* are likewise found: for, although these last named extend with the true *Liliacinæ* into the temperate regions, their predominance both in magnificence and number is in the equinoctial zones. To the above must be also added, in the statistical account of the vegetation of these zones, the Xyridaceæ, and the aquatic *Pontederiaceæ* and *Pistia* of the *Lemnaceæ*.

(1328.) In the northern regions the rushes (*Juncaceæ*), which are almost

absent from the intertropical zones, are the predominant or prevailing group of the Palmares; next to them are found some of the *Orchidaceæ*, the *Typhaceæ*, *Alismaceæ*, and *Colchicaceæ*, with the aquatic *Nayadaceæ*, none of which latter are however so decidedly northern groups as the *Rushes*, or as the *Mosses*, *Fungi*, and *Lichens* of the *Mycaffines*; for the *Colchicaceæ*, *Alismaceæ*, and *Nayadaceæ*, (although some of the latter, as the potamogetons, fill the frozen ponds and ditches of Lapland,) are also frequent in the temperate zones; and a few of them, as is common with aquatic plants, extend even into the equatorial regions.

(1329.) In the temperate latitudes the vegetation blends in part the characters of the polar and equatorial regions; the northern districts partaking mostly of the former's, its southern of the latter's flora.

Thus the *Juncaceæ*, *Typhaceæ*, *Nayadaceæ*, and *Colchicaceæ*, are all present, but gradually decrease in their prevalence as the parallels are lower; while the *Ephemeraceæ*, *Amaryllaceæ*, *Orontiaceæ*, and *Callaceæ*, as progressively lessen in the higher latitudes. The *Iridaceæ*, *Asphodelaceæ*, and the true *Liliaceæ*, are the predominating Palmares of the temperate zones; for, although extending on either side, they are by far the most prevalent in the extratropical and extra-polar regions.

(1330.) Thus it will be found that the relative proportion of the Palmares is greatest in the tropical, and least in the polar zones; that this relative predominance is still more marked in the petaloid and arborescent ones than in those which are herbaceous; and that it is the northern range of the Juncaceæ which lessens numerically the common or general proportion.

(1331.) This circumstance, taken in conjunction with the predominance of the grasses and sedges in the temperate and northern regions, explains the apparent paradox that the monocotyledons are relatively less in number to other flowering plants within the tropics, than either in the temperate or polar regions, notwithstanding tropical vegetation is said to be marked and distinctively characterized by them.

The vegetation of the tropics is not however, in fact, more characteristically distinguished by the presence of monocotyledons than that of the temperate regions; for the compact green turf which clothes the sides of our hills and extends over our plains, is a feature not less peculiar to the temperate zones than the Bananas and Palm forests are to the tropics; the difference is marked not so much by the absolute prevalence of monocotyledonous plants, as by their relative distribution, the arborescent and more splendid flowering tribes prevailing in the equatorial zones, the less showy and herbaceous ones in extratropical regions.

(1332.) Such being the case, it is found that these two classes, the Gramina and Palmares, which afford their chief supplies of food to man, afford it in different proportions in different latitudes. In the polar and temperate zones the cereal grasses yield almost exclusively the main supplies of food, while in the southern temperate, and equatorial regions, although still in many places most important, supplies are no longer exclusively, often not principally, derived from them; and in the majority of the South Sea islands corn is unknown, the Palmares, which in other parts more or less shared with the grasses the right of purveying human food, superseding entirely their use.

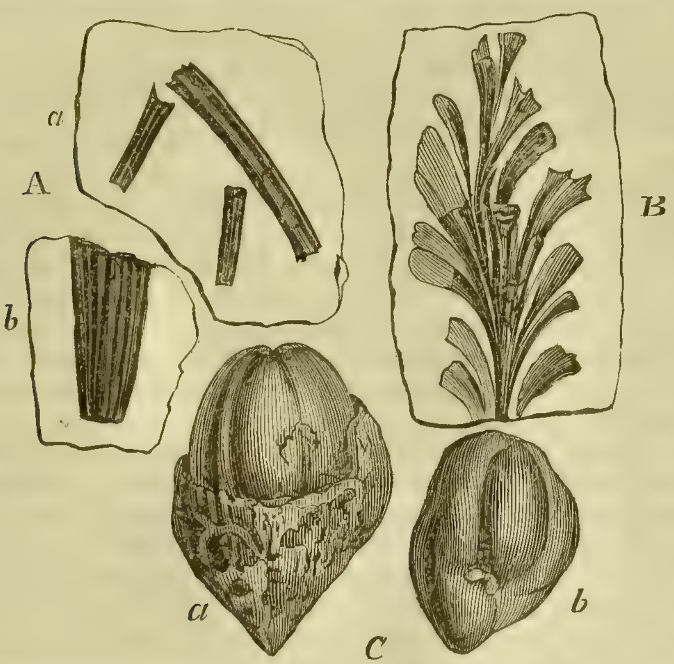
(1333.) Altitude, it is well known, affects the vegetation in as great a degree as latitude, so that palms and bananas may be the food of the inhabitants of the

plains, and corn that of those who dwell above the clouds, just as they are of the nations of the tropical and extra-tropical zones; for corn fields, which within the arctic circle are on the lowest lands, in the temperate regions rise on the sides of hills to the height of one, two, three, and even four or five thousand feet: and in the torrid zone they are elevated to eight or ten thousand feet above the level of the sea. Potatoes are cultivated at an elevation of above 12,000 feet, and some pasture grasses will grow even at the enormous height of between thirteen and fourteen thousand feet; while the corn fields, the palm groves, and the banana plantations, are all below them; and a traveller, descending Chimborazo from the regions of perpetual snow, would pass through the successive gradations of climate, and observe its progressive influence on vegetation to be analogous to that which would be witnessed in a journey towards the equator from the pole.

(1334.) Many places, however, have their climate much affected by other circumstances besides altitude and their distance from the equator. Thus islands have their atmosphere moist, their temperature moderated, and extremes are lessened both of heat and cold; and some places, such as Japan, would almost seem to have climates peculiar to themselves, as evinced by the effects on their characteristic vegetations.

GEOLOGICAL DISTRIBUTION OF THE PALMARES.

(1335.) The fossil remains already discovered in numerous strata, ranging from the coal series to the uppermost beds of the tertiary formation, afford sufficient proofs of the existence of the Palmares in those geological epochs during



A. *Cyperites bicarinata.* (*a*) Natural size. (*b*) Portion magnified, to shew the secondary veins.

B. *Noeggerathia flabellata*, reduced.

C. Fossil cocoa-nuts. (*a*) One with the pericarp in part destroyed. (*b*) Another entire.

which the successive strata were formed. Concerning three orders, viz. the MUSALES, LILIALES, and PALMALES, the evidence is full and complete; concerning the fourth, the JUNCALES, although satisfactory, it is less abundant and decisive.

(1336.) The rushes (Juncales) being the plants most nearly allied to the grasses, in structure, habits, and functions, might naturally be expected to obey the same law in their geological relations as it has been already shewn that they do in their geographical distribution; and this law is most closely followed by those groups which are the most grasslike, such as the *Juncaceæ* and *Restiaceæ;* and the least closely by those which are transitional to other sections, such as the *Pandanaceæ* and *Nayadinæ.*

(1337.) It has already been observed, in the "Outlines of Graminologia," that satisfactory evidence has not hitherto been offered of the existence of any grasses in a fossil state. The fossil named *Cyperites bicarinata* [1335, A, *a*, *b*,] there referred to as bearing the greatest resemblance of any known fossil to the Gramina, is acknowledged on all hands to be of very questionable affinity, and the fossil genera, *Endogenites, Culmites*, and *Poacites*, are at least as likely to be the remains or the impressions of *Juncinæ*, or of linear-leaved *Liliales*, as of grasses or sedges.

(1338.) A similar uncertainty prevails as to the former existence of the true rushes (Juncaceæ): negative evidence is all that can be adduced, no fossil remains of rushes having hitherto been found; and, their habits and functions being known, it is not improbable, reasoning from analogy, that in the earlier epochs they, as well as grasses, did not exist. The rushes are now the plants especially of cold and temperate latitudes; it is therefore unlikely that they should abound at a time when the present temperature of the tropics extended almost to the poles.

Echinostachys, the only fossil that bears any strong resemblance to the Juncinæ, is compared by Brongniart, not to the Juncaceæ, but to the southern group, the Restiaceæ.

(1339.) Of the *Pandanaceæ*, which now are tropical plants, some faint indications have been found; for the fossil stems of the coal formation, which have been named *Sternbergiæ*, are suspected by Brongniart to have belonged to a Pandanus or some plant of the same type, although, as he observes, they may be those of other arborescent monocotyledons, such as *Yucca*, *Aletris*, &c. A fossil fruit found in the tertiary strata has also a greater resemblance to the fruit of this than to that of any other natural group, and it has been therefore named *Pandanocarpum.*

(1340.) Eight or nine representatives of the *Nayadaceæ* have been found in a fossil state, the majority of which, seven species, bear so close a resemblance to the existing genus Zostera, that they have been called *Zosterites:* one is so similar to the modern Caulinia that it has been named *Caulinites;* and the other, concerning which there is a doubt whether it should be associated with the Nayadaceæ or Alisminæ, is considered by Brongniart so like the linear-leaved potamogetons, that he has converted the original name, *Phyllites*, into *Potamophyllites.*

(1341.) Of the *Acorinæ* no traces have hitherto been found in a fossil state.

(1342.) Excepting the doubtful Phyllites [§ 1340], the *Alisminæ* would appear to have been without representatives in the earlier ages of the world.

(1343.) *Palæoxyris*, a fossil discovered in the new red sandstone, has been so named from its resemblance to the modern genus Xyris; its relation, however, is not unquestionable. Should its presumed affinity be correct, it will be the only representative of the Ephemerinæ at present known.

(1344.) Of the former prevalence of the *Liliacinæ*, especially of the types Asphodelaceæ and Smilaceæ, abundant testimony is at command. Vestiges of the latter occur in the slate, the green and variegated sandstone, and the tertiary strata. The Bucklandia is a fossil stem, covered with fibres and the bases of non-amplexicaul leaves: perhaps it belonged to a forerunner of our Dracænæ or Xanthorrhœæ, as it is evident that the leaves were not amplexicaul, and the petioles distinct at the base. And Clathraria, one species of which has been found in the green sand-stone, is another stem that, notwithstanding the union of the bases of the leafstalks, is apparently allied to Xanthorrhœa. The two fossil species of Convallarites claim kindred with our present Convallariæ; but the immediate affinities of Antholithes is not so clear.

The only representative of the Smilaceæ yet discovered is the *Smilacites hastata* of the lower fresh-water formation.

(1345.) The indications of the Musales are very few, and those confined to the types of a single section, viz. the Scitaminæ; of the others no traces have hitherto been found. The Cannophyllites, referred to the Marantaceæ, is a fossil of the coal strata, but found in a bed of more recent date than the old and principal formation. Two species of fruit have also been discovered in the coal-measures, which are believed to have belonged to some pristine Musaceous plants, and hence have been called *Musocarpum prismaticum* and *M. difforme*. Amomocarpum, found in the tertiary series, is supposed to be the fruit of a plant related to the Zingiberaceæ; but Trigonocarpum, of which five species occur in the coal beds, although bearing the impress of the Palmares, does not afford means to trace its affinities further.

(1346.) The Palms alone now remain to be considered, and of them the stems, leaves, and fruit, have been discovered in a fossil state. The leaves are found chiefly in the coal formation, the stem and some leaves in the London and plastic clay, a few leaves in the lower fresh-water formation, and the rest, with the fruit, in various parts of the tertiary series.

(1347.) The successive geological epochs in which the several strata forming the crust of the earth were deposited, may be considered in some measure as equivalent to the various parallels of latitude that mark the zones and climates of the present surface; and hence, in the geological survey, besides the local distribution of the fossil remains analogous to the topography of existing orders, it is essential that the fossil floras of the several epochs should be considered, which view, in the fossil summary, is analogous to the vegetable statistics of the several zones.

(1348.) From the transition series, in which both marine Algæ and various ferns are found, the Palmares would seem to be altogether absent.

(1349.) Even in the coal measures, where the fossil remains of ferns are most abundant, only eighteen species (according to Brongniart's calculation,) belonging to this class have been discovered. Of these, three are the relics of true palms, one of the order Musales, and fourteen, the immediate affinities of which, as already shewn, are somewhat questionable, although no doubt exists that they are

vestiges of plants allied to the Palmares, and in all probability belonging to the groups to which they have been previously referred.

(1350.) In the variegated sandstones, although but five species are catalogued, remains of the flowering Endogenæ, says Brongniart, are more numerous, better characterized, and seem to shew, by the varieties of their forms, that they constituted more than a fourth part of the species of that epoch, notwithstanding they do not appear to have formed so much as a fourteenth part of the flora of the coal era.

(1351.) In the shelly limestones not any traces of these plants have been hitherto discovered. Indeed, the whole of the upper strata of the secondary series afford but few fossil remains of the Palmares: only three are named by Brongniart, two of which belong to the Jura limestone, and one to the Stonesfield slate.

(1352.) In the tertiary beds the Palmares again predominate; and, although not amounting to more than a fourth part of the Rosares, or angiospermous Exogenæ, they are in greater relative proportion in this epoch than any other class, save the one referred to, and hold to it the same proportion that the existing species of each do to each other in the present day.

(1353.) Exactly as it occurs with the other classes, so it is found with the Palmares, that the fossil remains in the upper tertiary beds bear the closest resemblance on the whole to the present existing race of plants: for example, several species of Cocos and of Flabellaria, and of plants so like Phœnix, Zostera, and Caulinia, are found, that they have been absolutely named *Phœnicites, Zosterites*, and *Caulinites*. Pandanocarpum and Amomocarpum are also the fossils of this epoch.

(1354.) In the fossil *Palmares* of the upper secondary strata the similitude is less close, but the resemblance, though fainter, when traceable, is still chiefly to the aquatic Palmares, or to those especially of our warmest latitudes. And in the coal formation this tendency is still more notorious, where the *Musocarpa* and *Sternbergiæ* alone are found, along with *Noeggerathia, Zeugophyllites*, and *Cannophyllites*, and the *Trigonocarpa*, the affinities of which with existing plants are extremely doubtful.

(1355.) It will hence appear, as far as conclusions may be drawn from the evidence attainable in the present day, which it is confessed as yet is meagre, that the Palmares, though not the earliest, were among the earliest plants which clothed the surface of the globe; and, although bearing but a small relative proportion to the ferns and other vegetables which purified the air in the coal epoch, still that they can be traced back to that age in which there is evidence that some representatives of the noblest tribes, as the Palms and the Bananas, flourished.

It is however subsequent to that period, when, as already shewn, it is probable that the grand operation of consolidating the atmospheric charcoal was principally performed, that palms and their allies attained their greatest relative proportion, in the coal era being not more than one-fourteenth, while in the upper secondary strata they formed one-fifth, and in the tertiary series one-fourth of the then existing floras.

(1356.) These geological positions are in strict accordance with their present geographical distribution, and with that scheme which similar geographical and geological researches in the preceding classes have indicated, and which, analogous

investigations into the physical conditions and relations of the succeeding ones will yet more fully confirm. Preparations are here made for the sustenance of amphibious and terrestrial animals, and especially of such as require immense supplies of vegetable food, and rather browse than graze. From the orders to which they are allied none of the fossil Palmares would appear to have been poisonous plants, none of them even suspected to have been deleterious; but all of them wholesome, and most of them very nutritious. It is affirmed by practical men that the *Musæ* of our tropics yield at least twenty times as much human food from a given space as corn or any of our cereal grasses; and if their immense leaves be taken into the calculation as fit provender for brute animals, as their fruit only is used by man, the amount would greatly be increased.

(1357.) Grasses however, or at least grass-leaved Palmares, may have been contemporaneous with the other orders, some of the fossils called Cyperites and Poacites being found in the coal measures, and others, as the *Culmites* and *Endogenites,* in the tertiary series; but it is evident, both from the direct proofs derived from the fossil witnesses which science has summoned to her council, as well as from the indirect testimony afforded by the well-known uses, habits, and functions of such plants, that, if they even existed, grasses and grass-leaved vegetables formed but a very small relative proportion of any of the ancient floras of the world.

(1358.) The Ferns, the Grasses, and the Palms, with their respective allies, associated to form the classes severally named Filices, Gramina, and Palmares, although differing greatly in many particulars, such as the want of flowers, the want of perianth, and the suppression of glumes, with the development of calyx and corolla, possess various characters in common by which they are strongly contrasted with other groups of classes, and are associated to form a region or province. Collectively considered, this triple alliance has been variously named, according to the views of various systematic writers; and as the Ferns, notwithstanding their tubivascular structure, are by some botanists of note pertinaciously denominated cellular plants, they are by such persons excluded from this region, and combined with the Mosses, Flags, and Fungi, with which their affinities are much less close. Habit, use, external form, and internal structure, all proclaim the first affinity of the Ferns to be with the arborescent grasses and the Palms; and even their secondary connexion tends rather to the Pines and Zamias, than to any class or order of the Mycaffines. Their destitution of flowers is in fact the only striking feature of resemblance between the *Filices* and the cellular flowerless plants: while the unstratified tubivascular stems of all, the jointed, fistulose stipitellæ, siliceous cuticle, and coniferous fructification of some; and the solid fariniferous stems of others, with circinnate vernation, or congested

linear foliage, shew very strong and numerous points of similitude between their several orders, and those of the *Palmares*, *Gramina*, and *Pinares*.

(1359.) Hence it will be evident that the various collective names which have been proposed are not all strictly synonyms; some being devised for the purpose of including, and others of excluding the *Ferns*. Thus *Monocotyledones*, or *Plantæ unilobatæ*, having reference to the embryo of the seed-bearing groups alone, are terms applicable to the Gramina and Palmares only; for the cotyledon in these plants is solitary, or, if two occur, they are alternate: and from such seeds, especially when replete with albumen, having been called grains, the plants which have them have been termed *Graniferæ*.

(1360.) The mode of germination and the intimate structure of the seed, have afforded other characteristics, and suggested another name; for in these plants the whole surface of the embryo is undivided, the radicle being inclosed in a case, the *coleorhize*, [§ 1270, *h*,] through which it bursts; and hence the term *endorhizæ*, which is far better and more correct than monocotyledones, even when applied to those plants alone which that term is commonly employed to designate, has been proposed by the celebrated Richard.

(1361.) Again, the disposition of the vessels in the stems, and their distribution in the leaves, forming veins, are peculiar. The structure is not homogeneous, as in the *Mycaffines*, but heterogeneous, being formed of tubes and cells; yet these tubes and cells are blended and mixed together in one mass, and there is no distinction of parts for the ascent or descent of the sap; in short, no *old* or *heart-wood*, *new* or *sap-wood*, *bark*, *pith*, &c. disposed in strata, (as will be found in the following region;) hence they have been called unstratified plants, for the cellular enchyma of the Mycaffines and the *vestigia foliorum* of the palms, do not deserve the name of strata any more than the hardened external rings found in their stems, in each of which, if at all distinguishable, those very parts are confounded together, viz. bark and wood, that in stratified plants are disposed in layers.

(1362.) The foliage in these unstratified plants appears also to be rather an expansion of the substance of the stipe than an exsertion of a distinct organ, as in the articulated leaves of the *Cresses*, and their allies (*Crescaffines*.) Hence the veins run

directly, in general, from the base to the apex or the margin of the leaves, without any anastomoses or reticulations. A single terminal bud is usually alone developed; and therefore, when a stem is formed, it is commonly unbranched and nearly cylindrical.

(1363.) But these three classes are characteristically associated not only by the unstratified structure of their simple, columnar, branchless stems; but it is observable that the oldest parts of those which are perennial are situated externally, and the newer fibres, by which the vital actions of the plant are performed, are deposited within the older ones, often quite in the middle of the stem, so that the centre is the softest and the most energetically active; the outer parts the oldest and the hardest, and scarcely, if at all, alive. This curious mode of depositing the annual growths which is prevalent in the *Palms*, the *Grasses*, and the *Ferns*, is diametrically opposed to that which prevails in the succeeding classes, in which, as will hereafter be shewn, the annual deposits take place externally. Hence these three classes of inside growers have been termed by De Candolle ENDOGENÆ, as the succeeding classes, which are outside growers, have been named, by the same distinguished botanist, EXOGENÆ.

(1364.) Although this is the general law of their increase, numerous aberrations prevail. Thus, in Xanthorrhæa, one of the Liliacinæ, and decidedly an endogenous plant, the walls of the stem are traversed by fibres in a radiating form proceeding from the circumference towards the centre. In their disposition these rays somewhat resemble a texture called the medullary rays in the Exogenæ; but the structures of the two are very different; in Xanthorrhæa, the rays consist of fibres or fascicles of tubes, going to nourish and support the leaves which crowd thickly the outside of the stem; in Cycas and the rest of the Pinares, and indeed, in all the Crescaffines, the rays are formed by plates of cellular substance only, running in a horizontal direction, and the individual cells of which lie partly over each other, constituting that form of *Enchyma* or pulp, which has received the name of muriform tissue.

(1365.) *Dracæna*, another liliacinous plant, the structure of whose unstratified stem would decidedly place it amongst the Endogenæ, even if no reference were made to its foliage and unilobate or monocotyledonous seeds, is still anything but strictly endogenous, *i. e.* inside growing. Its stem *is branched*, is *not* cylindrical, and increases in girth as it increases in age. For, according

to the description of Du Petit Thouars, each branch is connected with the stem by fascicles of fibres, which, instead of being all confined to the centre of a cylindrical shaft, force themselves between the dense woody axis or column which at first is formed, and the exterior mass of pulp or enchyma, and produce an external layer. But this layer, as to its contents, is still unstratified, and though situated outside of the previous deposits of vessels, so that the trunk increases in diameter, and much of the newer increments are external, still it differs much in its relative position from any annual stratum in the Exogenæ, and thus the Dracæna, if not a strictly endogenous or inside growing, but rather an exogenous or outside growing plant, is nevertheless virtually the same with the former, and differs from the latter in every essential point.

(1366.) *Pandanus* among the *Typhinæ* is another celebrated exception, both in its growth as an Endogenous plant, and its evasion of the limit set by their structure to the duration of its allies. The *pith-bearing rushes*, the *branching Asphodelaceæ*, and the *arborescent Gramina*, with their tapering non-columnar stems, as well as the *Smilaceæ*, *Dioscoraceæ*, &c. with the reticulate or subreticulate venation of their leaves, are all further examples of deviation in various ways from the strict and leading characters of the group. But these instances, and many others which might be adduced, as partially abnormal in the sections to which they belong, are possessed of a double interest. In the first place they are important when considered simply as gradations towards the structure confirmed in the third great region, the true *Exogenæ* or Crescaffines, which approach them by the *Cycadaceæ* of the *Pinares*, immediately to be described; and in the second, as affording ample proof that no one character is so universally present in this, and so constantly absent from other groups, as to form alone a sufficient and satisfactory diagnosis. The differential signs of natural associations are necessarily collective, and relative differences often depend on relatively different combinations only; therefore one or other, or even all the elements, may in turn be absent, and yet the concurrence of several, or of the majority, be rightly deemed conclusive.

(1367.) *Endogenæ*, it will therefore be perceived, is not a wholly unobjectionable term, although far preferable to *Endorhizæ*, and *Monocotyledones*, which are utterly inapplicable to this region when it includes the *Ferns;* for, notwithstanding in

them a preparation for flowering and rudiments of cotyledons exist, these parts can only be considered in them as the shadows which coming events have cast before; and hence a name derived from the inevitable tendency of the endogenous structure, viz. the *term* or *limit* which it sets to the existence of the plant, is here proposed in its stead. This tendency has already been explained [§ 77—79], and the adoption of the compound word TERMAFFINES in preference to *Termes*, has also been defended. It therefore need only be added, that this more comprehensive name does not imply any error; it simply states that the plants included possess a structure similar to those which inevitably perish by the consolidation of their cylindrical stems, whether they may by some abnormal course be enabled, as in Pandanus and Dracæna, to escape the common fate, or whether, as in many annual or herbaceous groups, they never reach the length of life, to feel the influence of the relentless band which their characteristic structure would, if they lived long enough, year by year confirm.

(1368.) The progressive gradations of structure by which the types, sections, and orders included in the several classes of this region, are distinguished from each other, and associated to form larger and larger groups, are, as already explained, relative rather than absolute distinctions; hence, although not designed for an index, a summary conspectus similar to that which concluded the history of the *Mycaffines* may be useful, as contrasting more strongly than any other means could do the various stages of development.

(1369.) Of necessity the chief differential characters alone are given in the following table, but as it is intended rather to illustrate the natural series of evolutions which proceed almost uninterruptedly from one stage to another through the whole vegetable kingdom, than to subserve the purpose of an artificial clue, constant references should be made to the preceding pages, for more full details whenever the connexions are forgotten.

TERMAFFINES. Tubivascular unstratified endogenous plants.	PALMARES. Non-glumose flowering endogenæ.	*Musales* *Liliales* *Juncales* *Palmales*
	GRAMINA. Glumose flowering endogenæ.	*Graminales* *Cyperales*
	FILICES. Flowerless endogenæ.	*Equisetales* *Pteridales* *Selaginales*.

Classes.	Orders.	Sections.	Types.	
PALMARES.	MUSALES. Inferior germen.	HYDROCHARINÆ. Tripetalous, exalbuminous.	*Vallisneriaceæ.*	Stam. fl. synpetalous, pistilline fl. apopet. capsular.
			Hydrocharaceæ.	Fl. apopetalous, fruit capsular, leaves with transverse veins.
			Stratiotaceæ.	Fl. spathaceous, apopet. frt. baccate, lvs. sheathing.
		ORCHIDINÆ. Gynandrous, (albuminous?)	*Orchidaceæ.*	Monandrous flowers, one-celled ovary.
			Cypripediaceæ.	Diandrous fl., one-celled ovary.
			Apostasiaceæ.	Di-triandrous fl., three-celled ovary.
		SCITAMINÆ. Tri-hexa-petalous fl., albuminous seeds, penni-nerved leaves.	*Marantaceæ.*	Monandrous, stam. lateral, anther one-celled.
			Zingiberaceæ.	Monandrous, stam. median, anther two-celled.
			Musaceæ.	Pent. hexandrous spathaceous flowers.
		NARCISSINÆ. Tri-hexapetalous fl., seeds albuminous, leaves nervo-striated.	*Iridaceæ.*	Triandrous fl., extrorse anthers, equitant leaves.
			Burmanniaceæ.	Tri- hexapet. fl., perianth winged or hairy, stam. mostly six.
			Amaryllaceæ.	Hexapet. hexand. fl., ensiform non-equitant leaves.
			Bromeliaceæ.	Tripet. hexandrous fl., ovary superior or inferior.
		TACCINÆ. Hexapetalous fl., grumous roots. Petiolate leaves, albumin. seeds.	*Dioscoraceæ.*	Per. subpetaloid, fl. separate.
			Taccaceæ.	Per. petaloid, fl. united, testa striate.
	LILIALES. Perianth petaloid, germen superior, ovules marginal.	LILIACINÆ. Hexapetalous fl., albumin. seeds.	*Smilaceæ.*	Per. subpetaloid, fl. separate or united, anthers introrse, testa membranous.
			Colchicaceæ.	Fl. hexandrous, anthers extrorse, styles trifid or [distinct.
			Liliaceæ.	Fl. hexand., anth. introrse, styles connate, testa soft and spongy.
			Asphodelaceæ.	————, anth. introrse, testæ black and brittle.
			Pontederiaceæ.	Stamens unequal, perianth irreg. and involute.
		ALISMINÆ. Seeds exalbuminous, embryo uncleft.	*Butomaceæ.*	Trophosperm branched.
			Alismaceæ.	Trophosperm simple.
		EPHEMERINÆ. Tripetalous flow., albumin. seeds.	*Ephemeraceæ.*	Capsule 2, 3-celled, placent. central, emb. trochlear, remote.
			Xyridaceæ.	Caps. 3-valved, 1-celled, parietal placentæ.
			Aphyllanthaceæ.	Placentæ central, emb. included, next to the hilum.
	JUNCALES. Per. none or glumaceous, germen superior.	JUNCINÆ. Glumaceous fl., alb. seeds, small emb., central placentæ.	*Juncaceæ.*	Emb.' included within the albu. next to the hilum.
			Restiaceæ.	Embryo lenticular, excluded, remote.
		NAYADINÆ. Seeds exalbuminous.	*Juncaginaceæ.*	Fl. united, glumaceous or achlamydeous, seeds erect, embryo cleft.
			Podostemaceæ.	United flowers, polyspermous capsules.
			Nayadaceæ.	Fl. separated and achlamydeous, carpels 1-seeded, ovules pendulous.
		ACORINÆ. Spathaceous and albuminous.	*Lemnaceæ.*	Fruit dry, capsular, indehiscent, axis abortive.
			Callaceæ.	Fl. achlamydeous, fruit fleshy.
			Orontiaceæ.	Fl. united, perianth scaly.
		TYPHINÆ. Ovary solitary, seeds albumin., leaves entire with linear veins.	*Typhaceæ.*	Ovules pendulous, leaves unarmed, anthers clavate.
			Pandanaceæ.	Ovules ascending, leaves armed.
	PALMALES. Arborescent stems, rigid divided leaves, hexapetaloid perianth, superior germen, median ovules, and albuminous seeds.	PHŒNICINÆ.	*Arecaceæ.*	Spathes when present complete.
			Phœnicaceæ.	Spathes numerous and incomplete.
GRAMINA.	GRAMINALES. Round articulated hollow culms, split vaginæ, embryo outside the albumen.	FESTUCINÆ. Arborescent or herbaceous, infl. paniculate, tendency to abortion in upper florets.	*Bambusaceæ.*	Locustæ many-flowered, stamens six, style single.
			Oryzaceæ.	Loc. one-flowered, glumes distinct and keeled.
			Stipaceæ.	Loc. 1, 2-flowered, glumes membranaceous, inferior glumelle coriaceous.
			Agrostidaceæ.	Loc. 1, 2-flowered, glumes and glumelles submemb.
			Avenaceæ.	Loc. 2, or many-flowered, stam. 3.
			Phalaridaceæ.	Panicles spiciform, loc. 1, 2-flowered, glumes keeled.
		PANICINÆ. Inf. spicate or paniculate, glumes keel-less, tendency to abortion in lower florets.	*Saccharaceæ.*	Infl. paniculate, rarely spiciform, loc. 1, 2-flowered, articulated.
			Miliaceæ.	Infl. spiciform, loc. 1, 2-flowered, non-articulate.
		TRITICINÆ. Inf. spicate, locustæ sessile.	*Spartinaceæ.*	Spikes unilateral, loc. sessile 1, 2-fl'd., upper impft.
			Hordeaceæ.	Spikes congested, locustæ sessile, styles two.
	CYPERALES. Angular, solid, jointless culms, entire leaf-sheaths; embryo included within the albumen.	CARICINÆ. Flowers separated	*Caricaceæ.*	Flowers separated, glumes developed.
		CYPERINÆ. Flowers united.	*Scirpaceæ.*	Glumelles pilose.
			Papyraceæ.	Glumelles absent.
FILICES.	EQUISETALES. Leafless, fistulose, articulate.	EQUISETINÆ.	*Equisetaceæ.*	Leafless, fistulose, articulate, frt. in terminal spikes.
	PTERIDALES. Foliaceous or frondose. Dorsiferous.	POLYPODINÆ. Thecæ annulate.	*Polypodiaceæ.*	Indusia absent, conceptacles naked.
			Aspidiaceæ.	Indusia present, conceptacles stalked.
			Gleicheniaceæ.	Annuli zonate, concept. sessile or subsessile.
		OSMUNDINÆ. Thecæ exannul.	*Osmundaceæ.*	Conceptacles one-valved and pellucid.
			Ophioglossaceæ.	Concept. bivalved, adnate, coriaceous opaque.
	SELAGINALES. Foliose, not dorsiferous, stems solid, inarticulate.	LYCOPODINÆ. Concept. dehiscent, or inclosed within the bases of the leaves.	*Lycopodiaceæ.*	Concept. free, axillary dehiscent.
			Isoetaceæ.	Concept. inclosed within the bases of the leaves.
		MARSILINÆ. Concept. free and indehiscent.	*Marsileaceæ.*	Concept. free and uniform.
			Salviniaceæ.	Concept. free, indehiscent, of two kinds.

OUTLINES OF PINAROLOGIA.

(1370.) The Pine, the Cedar, the Cypress, and the Yew, with other less familiar, but not less interesting plants, called Cycases and Zamias, are associated, to form a class which it has been proposed to denominate, from *Zamia* and *Pinus*, the Zapini, but for which Pinares, a word derived from the principal and normal genus, is perhaps a preferable name.

(1371.) This, the seventh class of the ascending series, is the first of the present region, which comprehends all the flowering stratified plants; plants which are strongly contrasted with those associated in the preceding one by their normal exogenous growth; an important structural peculiarity, which, from its not fixing any term to their duration, but allowing an indefinite increase, has suggested the common collective name *Cress-allies* or Cresc-affines.

(1372.) Two orders only are contained in the class Pinares; and from *Zamia* and *Pinus*, the respective normal genera of each, they have been named the *Zamiales* and *Pineales*.

These are two very interesting groups of plants, for a correct knowledge of which the world is chiefly indebted to Brown, Brongniart, and Richard. They were once the most perplexing, and apparently anomalous productions of the vegetable world, being never associated, but the latter placed sometimes with the ferns, and sometimes with the palms. Since, however, their true structure has been discovered, they have formed, together, one of the most natural classes existing, and become a beautiful transitional series, establishing still more strongly than heretofore the connexion between the *Pines* or *Fir-tribes* of the *Crescaffines* or *Exogenæ*, and the *Palms* and *Ferns* of the *Termaffines* or *Endogenæ*. For, notwithstanding the change in their systematic arrangements, which a knowledge of their intimate structure has entailed, still their affinity with Ferns and Palms is not slight; and it would be folly, as lately has been too common, to

neglect or deny their several points of similitude, such as the simple stems, coronal foliage, and circinnate vernation of the *Zamiales:* to say nothing of the sporidiferous fronds and terminal fructification of the ferns, which foreshadow the cones, with the rudimentary stamina, and pistilla and naked seeds of the whole of the PINARES.

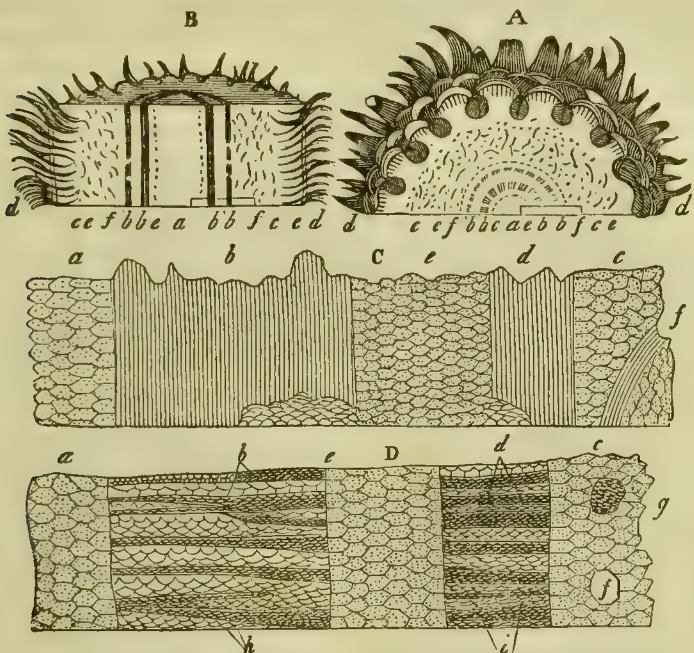
(1373.) In *Cycas* and *Zamia*, which, with the fossil (*Cycadeoideæ* or) *Cycoidaceæ*, constitute the order ZAMIALES, one bud alone, and that terminal, is normally developed. In the axillæ of the leaves, just as in the axillæ of palm-leaves, and the scales of bulbs, other rudimentary gems exist, but under ordinary circumstances they remain abortive. By art, however, these buds have been excited, and the plant propagated from such a scale; and further observation may not improbably reward the assiduous for their trouble by discovering a ramified Cycas or Zamia, in which, as in the *Doum Palm*, they are naturally evolved.

(1374.) The terminal bud in the *Cycases* and *Zamias* [§ 85, C, D,] being alone developed, their stems of course are simple, like the stems of unbranched palms, and like them also they are crowned with tufts of divided leaves called pinnato-sected or wing-cut. The venation of their foliage is linear, and not reticulate; the leaves few and large; and, when they fall, the stem is left covered by their remains or scars. These are all points of strong similitude with palms and ferns: here, however, their analogy with the *Palmæ* ceases, but with the *Filices* they have one more character in common, for the vernation of the leaves is circinnate, like that of the fronds of ferns; yet not bearing the fructification on the backs of expanded peduncles, as in the Pteridales, but on still further metamorphosed organs, and in congested spikes resembling in some respects the cones of the Equiseta. From all the ferns, notwithstanding their strong similitude, they are however distinguished by an important peculiarity, which brings them back much closer to the palms, viz. the greater development of stamina and pistils, and the formation of a cotyledonary seed.

(1375.) The organs of fructification are nevertheless peculiar to this order and the other which is associated with it, viz. the Pineales, and differ greatly both from palms and every other vegetables known, and in their organs of vegetation there are striking peculiarities also. A section of the stem of *Cycas* or of *Zamia* [§ 1376, also § 1393,] shews, instead of the unstratified textures of the Endogenous plants, a regular series of concentric woody circles formed of tubes and cells, surrounding a central pith, and surrounded by an external series of different form, and size, and thickness, which constitute the bark or cortex. These strata are traversed from the centre to the circumference by medullary rays formed of plates of muriform tissue, which are tracts of communication from the outer to the inner pulpy strata, or, as they have been called, the internal and external piths.

(1376.) Each layer or stratum is found on examination to consist of a series of tubes accompanied by a series of cells, the cells in the wood being chiefly within the tubes, the cells of the bark chiefly without. These distinct strata consist of structures equivalent to those which in palms extend from the terminal buds to the roots for the supply of nourishment to the crown of leaves and fruit, and here they perform a similar function; but the buds in the Pinares, something after the

plan of Dracæna, deposit their yearly growths external to the older parts; not however external to all, but exterior to the old wood and interior to the old bark, a layer being added, annually or rather by each crop of leaves, to each, and thus increasing the stems in diameter, the older wood receiving the name of *duramen* or heart-wood, the newer that of *alburnum* or sap-wood; while the newer bark is called the *liber* and the older, the *volumen*.



Anatomy of the stem of *Cycas revoluta*. A. Transverse section of half the stem. (*a*) Medulla or central cellular tissue. (*b*) Internal thicker fibrous zone. (ʻ*b*) External thinner ditto. (*c*) Cortical parenchyma, external cellular tissue, or external pith. (*d*) Bases of petioles. (*e*) Intercellular canals. (*f*) Fascicles of fibres passing from the external zone (ʻ*b*) to the petioles.

B. Longitudinal section of stem; the references are similar.

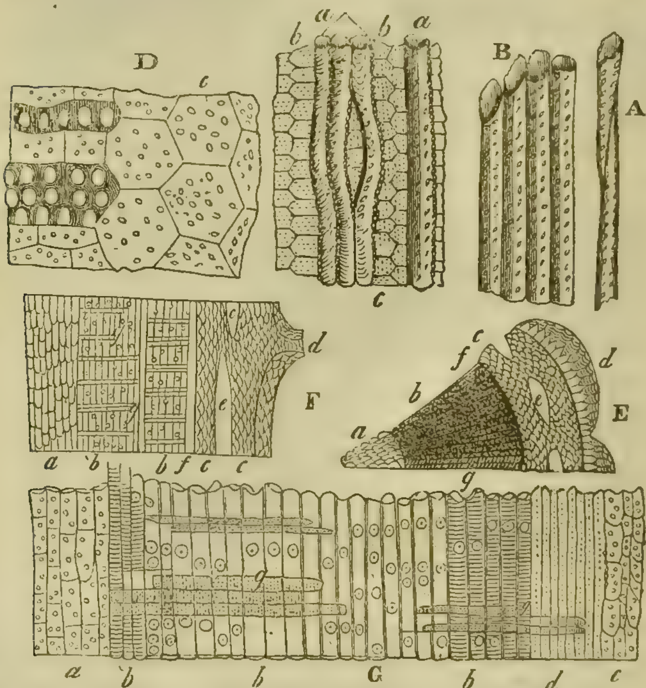
C, D. Portions of the longitudinal and transverse sections magnified; references similar. (*h*, *i*) Medullary rays.

(1377.) In the *Cycases* and *Zamias*, these layers are often peculiarly distinct, placed over each other like a series of cylinders, and, owing to the abundance of cellular texture, but loosely connected together, to what they are, in comparison, with their allies, the *Yews*, the *Cedars*, *Cypresses*, and *Firs*.

(1378.) The intimate structure of the vessels in this class associate the districts still more closely; and, as if to mark their affinity with ferns, the spiral tubes are in a very imperfect and rudimentary state; in some they are so few in number, that their presence has been absolutely denied. And, furthermore, the tubes of the wood in the Pinares are distinguished from the tubes of other plants by the extraordinarily large disk-like glands with which they are furnished, [§ 1379, A, B, G.]

(1379.) Adolphe Brongniart has published in the xvith volume of the "Annales des Sciences Naturelles," a very able monograph on the comparative anatomy of the stems of Cycas revoluta and Pinus picea. He well shews by extracts from various authors, how much truth is obscured by undue deference to authority,

A. Fibre of *Cycas* magnified, to shew the union of parts and the apparent pores or glandules. B. Several fibres taken in a direction parallel to the medullary rays. C. Fibres separated by medullary rays. (*a*, *a*) The fibres. (*b*, *b*) The medullary rays. D. Transverse section of fibres and medullary rays, and of the cells of the cortical parenchyma filled with fecula.



Anatomy of Abies picea. E. Transverse section of a yearly branch magnified. F. Longitudinal section of the same. G. Ditto of ligneous zone, much magnified. (*a*) Medullary cellular tissue. (`*b*) Fibrous zone of wood. (*b*) Fibres in contact with the medulla, which have been considered tracheæ on account of the transverse striæ. (*c*) Cortical cellular tissue filled with green granules. (*d*) Decurrent bases of the leaves. (*e*) Cryptæ, filled with resin. (*f*) Fibrous zones of bark. (*g*) Incomplete medullary rays. (The same letters of reference apply to the last three figures.)

and from neglect of reference to nature. For although Rheede, in his Hortus Malabaricus, had figured 150 years ago the stem of one of these plants as stratified, the example given having seven zones, modern writers of the highest eminence, amongst whom the two Richards may be mentioned, have uniformly described the internal structure to be unstratified, and similar to that of palms. And C. Richard, in his valuable Memoire on the *Cycadeæ*, says, in speaking of *C. circinalis*, (p. 187,) "Arbor . . . ligno albicanti, molli, uti in arboribus monocotyledonibus disposito." And Achille Richard, in following out the same opinion,

adds, "Ce stipe a la forme et l'organisation de celui des Palmiers, c'est-à-dire qu'il se compose de fibres réunies en faisceaux, et éparses au milieu du tissu cellulaire."

(1380.) It is evident, as Brongniart continues, that the above descriptions are those of the stem of the Sagus Rumphii, or some true palm; they are utterly inconsistent with the structure of any of the Zamiales. It is however extraordinary that Rheede's figure should have been stigmatized as incorrect, without examination, when it could so easily have been verified, the plants being cultivated in almost every conservatory in Europe.

(1381.) Dr. Buckland was one of the first to indicate the true structure of the *Cycadeæ*, in his examination of certain fossil plants, the natural affinities of which he was anxious to establish, and which he has shewn to be allied to the Cycases, and hence has named *Cycadeoideæ*. His figures are given, [in § 1393;] but they are far less satisfactory and copious in their details than those of Brongniart. [§ 1376 and 1379.]

(1382.) The general structure of the Zamiales and Pineales, as associating them with the other Crescaffines, has now been described. Their chief differences have been ably given by Brongniart: he says the Coniferæ differ from the true dicotyledons, by the nature of the tissues which form the ligneous strata of their stems.

These strata are scarcely separated into distinct fascicles, as the medullary rays are very narrow, incomplete, and scarcely visible. [Vide § 1379, fig. E, F, G.] The fascicles contain only one kind of tissue, consisting of elongated, pyriform cellules, all alike, analogous in their form to those which compose the wood of dicotyledons, but differing by their large glandular disks, which have been mistaken for pores; each is compassed with a border. In pine wood there is found, he adds, no trace of porous ducts, or false tracheæ, which are so common in dicotyledons.

He likewise believes that there are no true tracheæ, or spiral vessels, in these trees; for those which approach the nearest to them in appearance are not capable of being unrolled, and seem to be only a slight modification of the ordinary woody fibre, marked by transverse lines.

(1383.) These peculiarities, which distinguish the Coniferæ or Pineales from the other dicotyledons, are found likewise, with some modifications, to prevail in the Zamiales also. The chief differences are the great development of the parenchymatous system in the Cycases, while it is small in relative proportion in the Pineales; the medulla of these being scarcely visible, and the medullary rays imperfect, while in those the pith is so abundant, that it is extracted for economical purposes, and used as sago. The cortical parenchyma is in a similar way unequally developed.

The ring of fibrous tissue, on the contrary, which forms the most decided wood of the Pineales, is as it were degenerate and narrow; but still there are some of the Coniferæ, as the *Gingko biloba* or *Salisburia adiantifolia*, in which the cellular structure is more developed, and the woody zone less evolved; thus shewing an approach to the Zamiales.

(1384.) The most notable difference, however, in the organization of a stem of Cycas and a yearling branch of Pine, consists in the presence of fibrous liber in the latter, which fibres, if present, are not obvious in the former. They are, it

is true, very few in the pines; but upon this difference probably depends the difference of their growth.

(1385.) Another point of similitude and difference also deserves mention, viz. the cryptæ, or receptacles for proper juice, found in the external parenchyma: in the one case they are receptacles of gum or mucilage, and in the other of resin.

The two orders of the class Pinares, viz. the pines (or *Pineales*), and the Cycases and Zamias (or *Zamiales*), including in the latter group only the genera just named, and in the former the yews, firs, cedars, larches, and their allies, that have already been shewn to agree in so many particulars, exhibit a still further congruity in their organs of fructification, which are far less developed than in other flowering plants; indeed, but little raised above those of the [jointed ferns, or] Equisetales. For in both the spores or seeds are naked, having no closed pericarps; the leaves from which they should be formed being contracted into scales, that remain open and expose the ovula they bear. These ovules, however, are frequently invested with hardened persistent bracteæ, forming a false fruit called a cone or strobile, or occasionally becoming more or less succulent, as in the miscalled berries of the juniper (*Galbulæ*), and the yew (*Taxulæ*.)

(1386.) As a practical illustration of the series of changes which naturally occur in the several groups of plants, and which not only characterize the various classes and orders, but mark the successive evolutions of structure, a more beautiful instance can scarcely be found than that which has been pointed out by Brown, in his observations on the seeds and organs of fructification of the Pinares.

(1387.) In the Ferns, the organs of reproduction are seated either in conceptacles in the axillæ of the leaves, or on the back of the fronds, often contracted, as in *Lomaria, Osmunda, Ophioglossum*, &c. [§ 863,] to the form of scales, or sometimes within successive whorls of scales, forming a spike or catkin, as in *Equisetum*, [§ 68, D,] where rudimentary ovules and stamina are supposed to exist. In *Zamia*, the cones are formed of whorls of contracted leaves, bearing in the one case anthers, or perhaps naked pollen, and in the other ovules, the carpellary leaves on which they are borne not folding together, or uniting by their edges, to form a pericarp.

(1388.) In the Pineales, the leaves which form the strobiles or cones, are more fully developed than those which constitute the ordinary foliage of the plant. They are collected on a common elongated receptacle, or rachis; some are evolved as bracteæ, and others as antheriferous and ovuliferous scales; the ovules, whether few or many, always being exposed, and receiving the influence of the pollen immediately through the foramen, which was formerly mistaken for a sessile stigma.

(1389.) In the capillary leaves of the Zamiales, the ordinarily compound foliage is reduced to the form of scales, equivalent to those which result from the higher development of the simple leaves of the Pineales: in the one case, an extra evolution; in the other, a reduction being required to bring the ovuliferous scales to the same condition. Furthermore, in the Zamiales the pollen is probably naked, an opinion advocated by Linnæus; but in the Pineales it is enclosed in membranous sacs, although the scales which bear it are scarcely converted into anthers.

(1390.) The ovules in the Pineales are furnished with one, two, or even (ac-

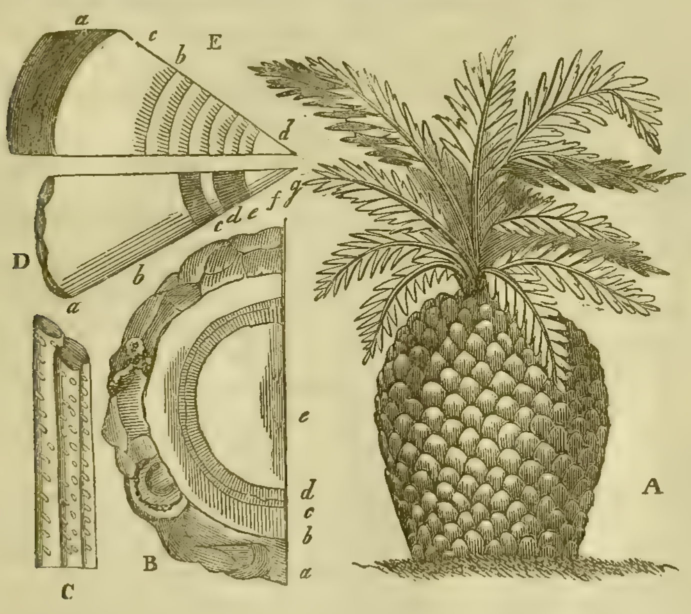
cording to Brown) in some rare cases, with three tunics, or proper seedcoats (testa and tegmen;) and the embryo, accompanied with horny, fleshy, or oily albumen, possesses two, three, four, or even as many as ten cotyledons; and the radicle, instead of being enclosed within a case, through which it bursts in germination, as in the *Endogenæ*, hence called also *Endorhizæ*, is here blended with the albumen, and undistinguishable from it; and therefore it is that these plants have been termed by Richard *Synorhizæ*.

(1391.) Their many cotyledons have given them in part the name of *Polycotyledones;* and, from their destitution of pericarp, they have been termed *Exogenæ Gymnospermæ* or naked-seeded plants, to contrast them with the other classes in which seed-vessels are present, and which are hence called *Angiospermæ*.

(1392.) Differentially considered, the Pinares are therefore gymnospermous or naked-seeded Exogenæ, with glanduliferous wood, and leaves having a linear venation.

ZAMIALES.

(1393.) This order includes but two, or at the most three, genera, and it neither requires nor admits of distribution into sec-

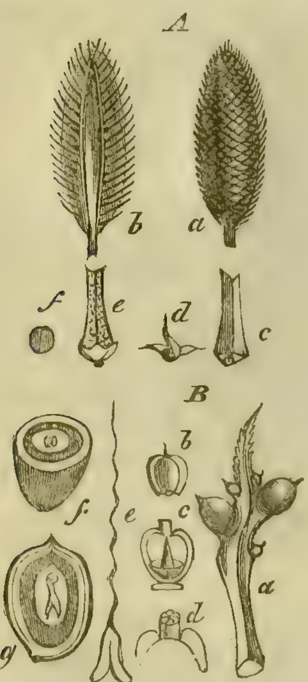


A. *Zamia horrida*. B. Transverse section of the stem, to shew its stratified structure. (*a*) The bases of the leaves. (*b*) The bark. (*c*, *d*) The new and old wood. (*e*) The voluminous pith. C. Glanduliferous [apparently porous] ducts. D. Section of *Cycas revoluta*, in possession of Dr. Brown, and figured by Dr. Buckland, to shew its concentric strata. E. Ditto of *C. circinalis;* the *Todda panna* of the Hortus Malabaricus, copied from Rheede, shewing seven laminated circles.

tions; for two of the genera, viz. *Zamia* and *Arthrozamia*, differ so little that they are most frequently united into a single genus: and *Cycas* bears so much similitude to both, that it is associated with them in a common type. The characters, therefore, of the type *Cycadaceæ*, and of the single section *Cycadinæ*, differ not from those of the order Zamiales, of which they are the sole contents.

(1394.) The *Zamiales* are exotic plants, having, as already observed, very much the general port and appearance of arboreous ferns or palms. [85, c, D; 1393, A.] Their stems are simple and branchless, rough with the scars of the successive crops of frondlike leaves, which are pinnate, and have a linear venation, the vernation being gyrate. The flowers are constantly diœcious; the stamineous ones being monandrous, achlamydeous, and collected into aments, which are sometimes very large. Each flower consists of a single staminiferous leaf or scale, not formed into an anther, but bearing the pollen exposed on its under surface, and associated in groups occasionally of twos or threes, but generally of fours.

The pistilline flowers differ in their modes of inflorescence. In *Zamia* and *Arthrozamia* they are collected into cones, the scales of which are thick and peltate, each bearing two flowers reversed. In *Cycas*, the inflorescence somewhat



Cycas circinalis.

A. Stamineous flowers.

(*a*) Entire cone, composed of antheriferous scales.
(*b*) Vertical section, to shew the rachis and exsertion of the scales.
(*c*) A scale detached, shewing the surface.
(*d*) The same, shewing its extremity.
(*e*) Ditto, shewing the polliniferous surface.
(*f*) A cluster of pollen.

B. Pistilline flowers.

(*a*) Rachis, or reduced leaf, bearing naked ovules on its edges.
(*b*) An ovule detached.
(*c*) A longitudinal section of a seed, shewing its coat and stigma-like foramen.
(*d*) Another view of the tubular foramen.
(*e*) Embryo detached.
(*f*) A transverse, (*g*) a longitudinal section of the seed, shewing the embryo within the albumen.

resembles the terminal fructification of the frondose ferns, the flowers being seated in depressions on the edges of contracted leaves or spadices, which thus assume rather the functions of fronds than leaves.

The ovules in both genera are naked, *i. e.* are destitute of pericarp, the carpellary leaves remaining in a rudimentary state, and the seeds have therefore no proper seed-vessel, nor any further covering than the scale to which they are attached. The ovules consist of a nucleus and one coat only; the embryo is seated in the midst of a fleshy or corneous albumen, and consists of two unequal cotyledons, which sometimes cohere; and the radicle is next the apex of the seed, is furnished with a long funiculus, and united to the albumen. The internal structure of the stem is decidedly exogenous, the strata loosely connected, and with much cellular structure and medulla. The ligneous tubes are glanduliferous, and apparently perforated; the whole of the plants likewise abound with farina and mucilage, and are devoid of resin.

(1395.) Differentially considered, the ZAMIALES are Pinares with simple stems, divided leaves, gyrate vernation, and mucilaginous secretions.

CYCADINÆ.

(1396.) CYCADACEÆ. Only five species of *Cycas* have been hitherto discovered; and they are all natives of warm countries, such as China, Cochin-china, Japan, the Molucca Islands, New Holland, New Ireland, and the isles of the South Sea. Two of them, viz. *C. circinalis* and *revoluta,* yield abundance of sago; that from the latter is very much esteemed as food, and the plants are cultivated in China and Japan as affording a staple article of diet: in many parts the pith of this species, or of the former, is the chief sustenance of the native Indians for three or four months out of every year. The fruit is also eaten in the Moluccas, and in Japan; it is however necessary to have it roasted or prepared in some similar way, as when eaten raw it is very astringent, and the kernels are said to have emetic powers. Labardiere states, that when steeped in water and fermented, a spirituous liquor is procured from the fruit of the *Cycas circinalis,* and that the fruit-bearing trees yield a white gum something like gum tragacanth, but more soluble. According to the experience of Captain d'Urville, it would appear that the young buds or cabbages of these palm-like plants are deleterious, for he states that two of his sailors were poisoned by eating one of them when in New Guinea.

(1397.) Seventeen species of *Zamia* and *Arthrozamia* have already been discovered; nine of which differ from the remaining eight in having the foliola articulated with the rachis of the frondlike midrib, and thus constituting the genus or subgenus *Arthrozamia;* while those in which the foliola are confluent with the rachis form the genus *Zamia.* A further difference has also been pointed out, viz. that in the former there is a preparation in the rudimentary stamen to form a two-celled anther, while in the latter the pollen is not disposed in two-lobed masses.

(1398.) *Zamia Cafra* is the *brood-boom* or *bread-tree,* of the Hottentots. Thunberg first noticed the profusion of pith the trunk of this tree contains; and Sparman says that the *Caffrarians* extract this sago-like substance and bury it wrapped up in calf-skins for several weeks, by which it becomes much softened, and then, when kneaded with water, they make it into bread.

(1399.) All the Zamiales contain mucilaginous juices, which, in their natural

state, have a nauseous odour and unpleasant taste, owing to a peculiar extractive matter that is readily removed by steeping in water, or by heat, or other processes of cookery, when they form agreeable and nutritious food.

PINEALES.

(1400.) Although varying considerably in size, some being among the most colossal vegetables known, and others small shrubs, the Pineales are none of them herbaceous, but all arborescent ligneous plants.

Pinus pinea.

A, *a*. Staminiferous ament. (*b*) A staminiferous scale isolated, and viewed from above. (*c*) Reversed view, to shew the anthers and pollen. (*d*) A seed germinating. (*e*) Embryo, to shew the numerous cotyledons. (*f*) Section of a mature seed-bearing cone, to shew the rachis, the scales or metamorphosed leaves, and the seeds.

B. Branch bearing cones in different stages of development. (*a*) Vertical section of a young pistilline cone. (*b*) The carpellary scale isolated, to shew its unclosed state and the two uncovered ovules at its base. (*c*) Side view of a carpellary scale. (*d*) A longitudinal section of the same. (*e*) Transverse section. (*f*) Scale detached from a ripe cone, shewing the mature seeds. (*g*) Seed with the wing-like scale removed. (*h*) Nucleus with the testa removed. (*i*, *k*) Vertical and transverse sections of the seed, to shew the embryo included within the albumen. (*l*) Ditto, more highly magnified.

Contrary to the normal condition of the Zamiales, they develop many buds, and hence their stems are more or less divided, and the branches often numerous. Their leaves are simple, with a linear venation, generally acerose or lanceolate, and for the most part persistent; the Larches and the Gingko being the only ones which are not evergreen. The foliage is sometimes in the form of imbricate lanceolate scales, resembling the leaves of the Lycopodiaceous ferns; at others the acerose leaves are collected into fascicles from the abortion of the axis of the branch, and then they are surrounded by a degenerate primordial leaf in the form of a scarious sheath, which bears some analogy to the *reticulum* of the palms, and the *ochrea* of polygonaceous plants. The flowers are separated, either monœcious or diœcious, and generally disposed in cones or catkins. The stamineous flowers are either monandrous or monadelphous, the anthers are two or more lobed, with an extrorse dehiscence: the stamens shew their rudimentary condition by frequently having an unconverted portion of the scaly leaf from which they are formed remaining as a crest. In the pistilline flowers the ovule is uncovered, the pericarpial leaf being either as in the solitary flowers, such as the yew, abortive, or, as in the coniferous sections, spread open in the form of a scale, and being destitute of style and stigma. The ovules in the true Coniferæ are in pairs on the face of the pericarpial scale, and inverted; in the others erect. The nucleus is invested with one or two membranes which remain open at the top, so that the access of the pollen is immediate. The fruit consists either of a solitary naked seed (Taxuie), as in the Yew, or of a galbule, as in the Cypress, or of a true scaly cone, as in Pinus. The seeds have a hard crustaceous testa, sometimes furnished with a wing, and the embryo, which has two opposite, or from two to ten whorled cotyledons, is placed in the midst of a fleshy and oily albumen, and is synorhizous, *i. e.* the radicle which is next to the apex of the seed is united organically to the albumen. [See also § 1394, 1431, 1441.]

(1401.) Hence it will appear that, although agreeing in numerous particulars with the *Zamiales*, this order, differentially considered, may be known by being resinous *Pinares*, with branched stems, simple leaves, and non-gyrate vernation.

(1402.) The elder Richard, who published a very learned dissertation on these plants, has distributed the order into three subordinate groups or sections, which, from the Fir, the Cypress, and the Yew, the normal genera of each, have been called respectively the Abietinæ, the Cupressinæ, and the Taxinæ.

(1403.) In the Abietinæ are included all the genera in which the pistilline flowers are reversed, and whose fruit is a true scaly cone.

(1404.) In the Cupressinæ are found all those Pineales in which the pistilline flowers are erect, united many together in the axillæ of scales, which are few in number, and form frequently a fleshy galbulus.

(1405.) In the Taxinæ are comprehended the remaining genera

in which the pistilline flowers are distinct from each other, attached to a scale or in a cup; and the fruit a simple naked seed.

ABIETINÆ.

(1406.) Linnæus blended the true Pines, the Firs, and the Larches, in a single genus. The propriety of this union, which was however always questionable, can now no longer be defended, and botanists in general have agreed to recognize those distinctions which have long been popularly established. The Pini of Linnæus are therefore now distributed into the genera *Abietes* (or Firs), *Pini* (or Pines), and *Larices* (or Larches), which, with *Dammara*, *Araucaria*, and *Belis*, form the section ABIETINÆ, and they differ so little from each other in essential points of structure, that they are all associated in the single type *Pinaceæ*.

(1407.) PINACEÆ. Some of these plants appear to have originally derived their names from the places of their growth, and, being mountain-trees, were called Pines, from the Celtic *pin* or *pen*, a rock or hill; like as our towns, Pen-ryn, Pen-rith, Pen-maen; and the Spanish ones, *Penna-flor*, *Penna-fiel*, and others, have been so called, either from being built on hills, or embosomed in the mountains. And this word, as the common root, can be traced through many languages: thus, *Pin* in Armoric and modern French, *Pino* in Spanish and Italian, *Peigne* in Erse, *Pinua* in Welsh, *Pinu* in Anglo-Saxon, *Pine* in English, *Pyn-baum* in German, and *Pyn-boom* in Dutch, are all evidently but variations of one root. Others, as *Belis*, have been so named from the javelin-like appearance of their leaves; while *Abies* is whimsically conjectured to be a derivative of *abeo*, to depart; an ejaculation of wonder at the extraordinary height these FIRS attain, converted into a generic name; but it is more probably a corruption of the Celtic *abetoa*, or the Greek ἄβιος, as Hesychius calls the fir-tree Ἀβιν.

(1408.) The FIRS (*Abietes*), are at once distinguished from the true *Pines* and *Larches*, by their pyrimidal growth and solitary leaves; as well as by the scales of the cones being slender and rounded.

(1409.) The species associated to form the genus *Abies* are distributed into two subgenera, which are familiarly known as the *Spruce* and the *Silver Firs*. In the Silver Firs (*Piceæ*), the leaves are all turned to one side of the branches, while in the Spruces (*Abietes*), they are spread equally all round.

(1410.) The most important species of spruce firs are the Norway Spruce (*A. excelsa*), the black and red spruces of Canada (*A. nigra et rubra*), and the Douglas spruce; the A. alba and orientatis are of much less value, the timber being of inferior quality, untractable, and subject to the worm; and the A. Menziesii, although well spoken of, has not been hitherto sufficiently proved to be safely recommended. The Canadians procure the thread with which they sew together the birch-bark their canoes are made of from the root-fibres of the white spruce, and with its resin the seams are rendered water-tight. The bark of this, as well as of other species, has been occasionally used for tanning.

(1411.) The black and red spruces, which are believed by some botanists to be merely varieties of the same species, afford most valuable timber. They are natives of some of the most inhospitable regions of North America, giving them a dark and dismal aspect, whence they have been called black swamps, or black-wood lands. Vast quantities of these timbers are annually exported from Canada to Europe. For example, in one year (1831) there were shipped at Quebec

			£.	s.	d.
Spruce and pine deals twelve feet by three inches thick, and eleven in width	16,466,795	Valued on the spot without freight at	104,105	9	2
Boards and planks	107,108				
And from New Brunswick, super. feet 21,782, equal to deals of three inches	800,740	Ditto	50,000	0	0
			154,105	9	2

From the spray of these firs is extracted the essence called spruce, with which that wholesome beverage, spruce beer, is made. Lambert's informant was in error when he stated that the essence of spruce is procured from the A. alba, the leaves and spray of that fir being carefully avoided on account of their unpleasant flavour. The roots of both the black and red spruces are used as well as those of the white, as thread, by the Northern Indians, to stitch together the sheets of birch with which their frail-looking but invaluable canoes are built. The roots merely require splitting when too thick, and after moistening are twisted into thread, which is preferred in Canada to European twine and cordage.

The *Abies Douglassi*, named after its enterprising discoverer, is a most noble tree, growing to the height of from 150 to 180, or 200 feet, and being occasionally found to exceed eight-and-forty feet in circumference. It yields abundance of fine clear resin, the timber is heavy, firm, of a dark colour, and not liable to warp. It is likewise a very quick growing tree, hardy, and, by the praiseworthy exertions of the Horticultural Society, it will no doubt be common in a very few years in British forests and plantations.

(1412.) The Norway spruce (*A. excelsa*), supplies in Europe the place which the *A. nigra* and *rubra* fill in America. They chiefly differ in aspect from the Norway spruce by having branches which spread almost horizontally, while those of European species are pendent or incline towards the earth. This fir abounds in the north of Europe, and its timber is exported in enormous quantities from the various parts of Russia, Norway, and Denmark. The *Christiana* deals are the most esteemed, and bear the highest price. In 1828 we imported from Norway, chiefly from Christiana and Bergen, 5170 battens and batten-ends; 11,229 deals and deal-ends; 3721 masts, yards, &c. under twelve inches diameter, and 13,506 loads of timber eight inches square or upwards. In the higher latitudes of Siberia, where this spruce abounds, it is considered by the wandering tribes as a certain sign of the presence of springs of fresh water, for, according to Gmelin, it is only met with in the neighbourhood of springs or in moist places.

(1413.) Of the Silver firs (*Piceæ*), the most important species are the *A. balsamea*, *Canadensis*, *nobilis*, and *Picea* or *pectinata*. The *A. Smithiana*, or Indian silver fir, is chiefly remarkable for its enormous size, the Abies *Brunoniana*, from its leaves being peculiarly deciduous, which is rare among these plants, and

the *A. religiosa,* which is the sacred fir of Mexico, from its branches being used to adorn churches and in religious ceremonies. It is not known that any of these afford valuable timber; indeed, the wood of several is of very inferior quality, as is also that of Abies *Sibirica* 'and *grandis,* the latter of which grows to the height of upwards of 200 feet.

(1414.) From the *A. Webbiana,* which is a native of Northern India, a purple pigment resembling indigo is extracted; it is there called *Oumur.* The bark of the *A. canadensis* is more valuable than its wood; the latter is fit only for the fire, but the former is said to equal oak-bark in its tanning powers. In Canada and the United States it is greatly used, and even preferred to oak-bark, for tanning sole leather; but, according to Mr. Gould, although "small consignments of it have occasionally been made to London, the tanners could not be induced to give it a trial." Its spray yields freely the essence of spruce.

(1415.) The *Abies balsamea* or balm fir, yields the famous Canada balsam. This turpentine or balsam is found in the numerous cryptæ of the bark, whence it is extracted by incision, and received into shells or cups. When I visited the village of Indian Lorette, says Mr. Gould, in his interesting Essay on the Pines of Canada, in 1828, two of the chiefs, who had been in England two years before, were then absent collecting it. Perhaps there is not a better varnish for water-colour painting than is prepared from this liquid resin. The branches of this, as well as of the hemlock spruce, are used by the Indian and Canadian voyagers to sleep upon. In their winter journies they scrape the snow together with their snow-shoes, making a kind of wall on each side of their lair, and then strewing the ground with branches, wrap themselves in their blankets; thus defended, they sleep in security when the thermometer is many degrees below zero. In this way, between two Indians, did Captain Thompson sleep, in his unsuccessful attempts to overtake Captain Franklin in his arctic journey. This is one of the few firs that will bear clipping well, and hence it is adapted for screens and hedges.

(1416.) The *Abies picea* (or Picea pectinata), is the sapin of the French, and, as its name imports, it abounds with resin, which is commonly known as Burgundy pitch and Strasburgh turpentine. It is a very handsome tree, and is probably the *Abies pulcherrima* of Virgil; for, although common on the continent, it is not a native of England; and the *Abies* is one of the trees which Cæsar states he did not find in Britain.

(1417.) The Larches (*Larices*), are scarcely distinguishable generically from the firs, and by some botanists they are included in the same genus, Abies, of which they form two further sections. But as the Larches and the Cedars, although they agree in having the scales of the cone slender and rounded like those of the firs, differ in the fasciculate arrangement of their leaves, and in the ovule foramen being cleft as in *Pinus,* and not hemispherical and cupped as in *Abies,* it is more convenient to associate them as a genus or subgenus, thus distinguished from the firs in which the leaves are solitary.

(1418.) The Larices are distributed into two groups, the *true Larches,* in which the leaves are deciduous, and the *Cedars,* which are evergreen.

(1419.) The common larch is the most valuable of all the species associated to form this small subgenus. *Larix pendula* is chiefly remarkable for the graceful curve its leading shoot assumes, drooping towards the ground when about fifteen or twenty feet in height, and forming a natural arch of extreme elegance and

beauty. The red larch (*L. microcarpa*), is a handsome tree, but very slow in its growth, and hence not so well suited as the common species for profitable planting. Its wood is dense and heavy, so that it will scarcely float in water. The common larch (*L. Europea*), is a noble and hardy tree, growing freely on the mountains of central Europe, and even as far north as Siberia. It seems to delight in exposed barren situations; and in Siberia it forms vast forests, sparingly intermixed with firs and pines; for, contrary to the habits of the Norway spruce, it is intolerant of wet and swampy situations. The timber of the larch is only second in value to that of the naval oak, and it has in many instances superseded the use of this latter wood, being much superior to most of the oak of foreign growth. The Dukes of Athol have planted the larch very extensively at Dunkeld, and their example has been followed by many patriotic persons in various parts of the British isles. The larch grows freely upon some of our most exposed and barren lands, forms timber rapidly, and is one of the most profitable forest-trees; for some grown at Dunkeld, when only eighty years old, yielded each six loads of the finest timber.

(1420.) Much prejudice has existed against the use of the larch in ship-building; and some persons have not scrupled to call larch vessels "leather ships," and "sailors' coffins." But the following statement, given by Mr. Gould, will shew that such notions could only have been founded upon ignorance. "In 1809, larch timber, grown by his grace the Duke of Athol, at Dunkeld, was first used in the British navy at Woolwich, in the building of the *Serapis* storeship, the *Sybille* frigate, the bottom of a lighter, and for piles driven into the mud, alternately wet and dry; and in all these situations proved a durable wood. The *Athol*, of twenty-eight guns, was also built entirely of larch timber from his Grace's estate; and at the same time the *Niemen*, of the best Riga. After their first course of service, on being examined, the *Niemen* was found in a decayed state, and condemned accordingly; whilst the *Athol* was again put into commission, and is at this time (December, 1832,) on a voyage to the West Indies. It was also remarked that, during the time this larch timber lay in Woolwich dock-yard, exposed to the weather, neither the heart nor the sapwood were in the least decomposed; nor was there the slightest appearance of fungi growing upon it."

(1421.) The bark of the larch is nearly as valuable to the tanner as that of the oak. Venice turpentine is the produce of this tree; it also yields a gum which is known as that of Orembourg. This gum is said to issue from the heart-wood, while the turpentine comes from the cryptæ of the bark: it is wholly soluble in water, like gum arabic, and supersedes its use in some few places. The mode in which this substance is commonly procured is remarkable. It occasionally happens that whole forests of larch, in different parts of the Russian empire, are consumed by fire, either accidentally or wilfully ignited. During the combustion this gummy matter issues from the inner parts of the trunk; it is diligently collected by the natives, who esteem it a delicate food. It is also supposed to be an antiscorbutic. Exudations also are found on these firs which resemble manna, instead of which they are used, under the name of *manna of Briancon;* but this manna is said not to have more than half the cathartic power of that of the East.

The inner bark, when boiled, mixed with rye-flour, and buried for a few hours in the snow, furnishes the hardy Siberian hunters with a ferment, which they use instead of leaven, when that substance is spoiled, as it frequently is, by the severity of the cold.

(1422.) The Cedars, botanically considered, are evergreen larches, but the name *cedar* has been popularly given to several other trees besides those to which it of right belongs; such as the *Juniperus virginiana, Cypressus thurifera,* and even the *Cedrela odorata.* The cedar of Lebanon (*Larix cedrus,* or *Cedrus antiquorum*), is the most celebrated species; and next to it the sacred cedar of India, (*L. Deodara.*) The other associated species are but little known; they are the *L. Kæmpferi, Thunbergii, Torano, Araragi,* and *Momi:* the wood of the latter is white, and is much esteemed on account of the fineness of its grain.

(1423.) The *Deodara,* which the Hindoos call *Devadara* or *God-tree,* is a majestic cedar, which they hold in high veneration. Its wood is said to be extremely durable, and so full of resin, that strips of it are used instead of torches and candles. Spars of this cedar, in a sound condition, have been taken out of Indian temples, known to have been built from two to four hundred years. Mr. Lambert says its wood is close-grained, takes an excellent polish, and is perhaps one of the most valuable of the pines; certainly much more valuable than the timber of the cedar of Lebanon, which affords only an inferior sort of deal, that is very destructible. Cedar wood has long been famed for its durability; but such enduring timber was, it is confessed, the produce of other trees. Lambert conjectures that it was the wood of the *Cupressus horizontalis;* Sprengel believes it to have been that of the *Juniperus oxycedrus;* and Mr. Drummond Hay refers with still more probability to the *Thuja articulata,* which affords a beautiful, hard, deep brown, and almost indestructible timber. James II., when Duke of York, had a cedar table eighteen feet long and nine feet in breadth.

(1424.) The cedar of Lebanon, though not a lofty, is a very noble tree; its stupendous arms, each exceeding the bulk of ordinary forest-trees, spreading abroad on every side, give it an inexpressible magnificence of port. Mount Lebanon and the range of Taurus are the native places of these stately plants; but they grow freely in Britain, and various other parts of temperate Europe. This tree, which has been well called "the glory of Lebanon," would seem to have flourished on that mountain in former times in vast abundance; but, from the small number found there at present, it is conjectured by some antiquarians that they have never recovered the inroads which were made upon them by Solomon and Hiram, who did "all his desire concerning timber of cedar, and concerning timber of fir," and who had "fourscore thousand hewers in the mountains," besides "threescore and ten thousand who bare burdens;" and these men hewed "the cedar-trees out of Lebanon, and brought them down from Lebanon to the sea." Some venerable ruins, as memorials of bygone glory, however, yet remain, although they are so much lessened, that, as Isaiah says, a child may number them. In the year 1550, Peter Belon counted twenty-eight; in 1609, Litgow found but twenty-four; in 1650, Le Gouz reports that only twenty-two were left; in 1699, these, according to Maundrel, were reduced to sixteen; and, in 1789, Billardière states that seven were all that had escaped the ravages of time. Of these several were of enormous growth: according to Binot, they raised their proud summits to the height of sixty, eighty, or one hundred feet. Gabriel Sionita says that five men together could scarcely fathom the trunk of

one; and Maundrel, about one hundred and fifty years ago, found one of the largest, then quite sound, to measure twelve yards and six inches in girth. These relics of past ages, these memorials of the glory of other years, are now preserved with religious strictness, and the Maronites, a sect of Christians dwelling on Mount Lebanon, celebrate an annual festival under their patriarchal boughs, which is called "the feast of cedars."

(1425.) The true pines, like the firs and larches, have been distributed into three subgeneric groups, differing from each other in the number of leaves enclosed within the scarious vagina which is common to the whole, and by the presence of which, as well as by the scales of the cones being clavate and angular, instead of round and membranous, the *Pini* are distinguished as a genus from their associates, the *Larices* and *Abietes*.

(1426.) The *Scotch*,[1] the *Jersey*,[2] the *Corsican*,[3] and the *Aleppo*,[4] with the *dwarf*,[5] the *cluster*,[6] and the *stone*[7] *pines*, are examples of the *Pinasteres*, or those in which the leaves are found in pairs. Of the *Tædæ*, or three-leaved pines, the *frankincense*[8], the *foxtail*,[9] the *Canary*,[10] the *swamp*,[11] and the *long-leaved*,[12] are the most important species. Of the *Strobi* or five-leaved pines, the *Weymouth*,[13] the *Siberian*,[14] the Nepal *excelsa* (Lambert's), and the *occidentalis*, are the chief at present known.

(1427.) The Scotch pine (*P. sylvestris*), is the only one of the genus indigenous to Britain, and here it is confined naturally to the northern parts of the island. At Invercauld, in Inverness-shire, and Gordon Castle, Aberdeenshire, are the largest and finest pine forests in the country. This tree is a native also of the Alps, and in the northern parts of Europe it is abundant, forming large woods in exposed and otherwise barren places. It will grow almost in any soil, but dry highlands are most favourable to the development of good timber. Two varieties of this pine afford the white and red deal of commerce; it also yields abundance of turpentine, resin, pitch, and tar. The resin is procured by wounding the tree, the tar by distilling the wood, especially that of the roots. Next to the larch, this species affords the most valuable and useful timber. Fir wood has always been esteemed for the manufacture of musical instruments, and it is from the timber of this pine that sounding boards and the breasts of violins are usually made.

(1428.) The bark-bread (*bark-broed*), of the Norwegians,

[1] P. sylvestris. [2] P. inops. [3] P. laricio. [4] P. halepensis.
[5] P. pumilio. [6] P. pinaster. [7] P. pinea. [8] P. tæda.
[9] P. serotina. [10] P. canariensis. [11] P. palustris. [12] P. longifolia.
[13] P. strobus. [14] P. cembra.

which Linnæus states the Laplanders eat during a great part of the winter, and sometimes even during the whole year, is a preparation of the inner bark of this pine. The bark for bread-making is selected from the older and least branching trees, for the young sprays and small branches contain too much resin; the alburnum is soft, white, fibrous, and succulent, and is stored up at those seasons when it separates easily from the older layers. When the natives are about to convert it into bread, it is slowly baked on the coals, and, being thus rendered hard and porous, is ground into powder, which, when kneaded with water, is made into cakes. The outer bark, which is light, is used by the fishermen, instead of cork, as floats for their nets. The young shoots when just beginning to appear are collected by the children of the peasants, and esteemed as food; when properly prepared, they form a wholesome and agreeable salad. They are also stored as winter fodder for the rein-deer.

(1429.) The Frankincense or loblolly pine (*P. Tæda*), overruns large tracts of land in the southern parts of North America: it grows freely in this country, and its timber is said to be superior to that of the Scotch species. The pitch and the Jersey pines (*P. rigida et inops*,) are among the most prolific of the whole in turpentine and resin: from the condensed smoke of the burnt wood of these, as well as of other species, when the pitch and tar have been extracted, lamp-black is procured. Pitch is extensively used in shipbuilding, and, mixed with whale-oil, it forms the various kinds of anti-attrition and grease for cart and carriage wheels.

(1430.) The Strobi are splendid trees; and one of the most noble is the Weymouth pine. It grows in Canada to the height of 150 or 200 feet, and is often found fifteen feet in circumference. Its age is unknown: 1500 strata have been counted in the trunk of one. From the large size of this pine, and the durability and tractibility of its wood, enormous quantities are converted into timber. It affords the largest masts for our men of war, and is much esteemed for water woodwork and water-courses. The almost impenetrable forests where these pines abound would seem to forbid their use by man; but, although perhaps not one in ten thousand of the trees, as they naturally grow, is fit to be cut even for common timber, so great is the demand, that roads of considerable length are made through the woods, for the purpose of conveying the timber from its place of growth to the nearest river. Large parties of men, called Lumberers, are engaged in these

enterprises: each gang, from thirty to fifty, is termed a *shanty*, (from the French *chantier*,) and requires an advance of from 1500*l*. to 2000*l*. to purchase horses, oxen, and provisions for men and cattle during the period of the adventure; for they are generally absent for seven or eight months, or more, in desert regions, where no help is.

(1431.) P. Lambertiana, which is a native of *California*, is a very majestic tree. One blown down, that Mr. Douglas measured, was 250 feet long and fifty-seven feet nine inches in circumference at three feet from the root; and he saw some of the same pines then standing which were larger. The timber is light and soft, and the resin, which is of a fine amber colour, becomes, when the wood is partly burned, converted into a sort of sugar, for which it is used as a substitute. The Canadian pines grow to a most stupendous height. Mr. Cox measured one whose trunk was 150 feet clear of branches, and the whole height not less than 300 feet. This monarch of the woods was worthily dignified by the Canadians under the title of "*Le Roi de Pins;*" but Mr. Cox found one in Columbia still larger, the trunk being fifty-seven feet in circumference, and 216 feet clear without branches. European trees seldom attain so immense a magnitude; but the Hedsor yew [§ 1446] is upwards of eighty feet in circumference; and Strabo mentions a pine upon Mount Ida which he says measured twenty-four feet in diameter. The seeds of *P. Lambertiana* and *Cembra*, as well as those of other species, are eaten, and in some places much esteemed.

(1432.) The New-Zealand kawrie (*Dammara australis*), the Norfolk-Island pine (*Araucaria excelsa*), and the other associated species and genera included in this type and section, differ not essentially in their properties and uses from those already described. Some of them are immense trees, rising, as does the kawrie, to the height of two hundred feet, and furnishing good timber. These are indeed what the poet so well describes as

> "Vast and giant models of their kind,
> Which in far distant regions of the globe
> Sequestered stalk, with lifted heads on high
> O'ertowering Atlas."

The Amboyna pitch-tree is the *Dammara orientalis;* the fresh fruit of *Araucaria excelsa* is eatable; and *A. imbricata* is both a curious and interesting plant, its closely imbricated foliage resembling a coat of mail.

CUPRESSINÆ.

(1433.) Thujaceæ. The land of the Cypress has given its name to the trees

Juniperus communis.

A. Branch bearing pistilline flowers.

(*a*) Stamineous ament.

(*b*) Antheriferous scale.

(*c*) Pistilline ament.

(*d*) Vertical section of the same, to shew the erect ovules within the superior scales, the stigma-like foramina, and exposed nuclei.

(*e*) Ripe fruit.

(*f*) Section, to shew the seeds.

(*g*) Seed detached.

(*h*, *i*) Sections shewing the embryo included within the albumen.

(Cupressi, *κυπάρισσοι*), which chiefly abound in its forests, as well as to the metal (Cuprum, *κύπριος*), which was first extracted from its veins.

Cupressus, and its allies, *Thuja*, *Taxodium*, *Callitris*, and *Juniperus*, are associated to form the second section of the order Pineales, which, from the first named genus, has been called the *Cupressinæ;* and from the second, as they are all included in a single type, this type has been termed *Thujaceæ*.

(1434.) *Thuja*, the *arbor vitæ* or tree of sacrifice, was originally called *Thuya* (*θῦα*, from *θυω*), as its wood, from the pleasant odour it gives out when burned, was frequently used in sacrifices. The two species most commonly cultivated in this country are the Chinese and the American, (*T. orientalis* and *occidentalis.*) *Thuja pendula* [§ 51, B], from its sombre foliage and drooping boughs, has a very melancholy aspect, and is said to be planted by the Greeks in their burial-grounds as a symbol of mourning. In the black lands of the Missisippi (says Mr. Gould) there are immense tracts covered with the Thuja occidentalis, than which no prospect on earth can be more gloomy. It might have been supposed that the ancients who dedicated the Cypress to funeral rites had seen these "Dismal Swamps:" nothing so forbidding in the way of vegetation exists in Europe.

Here the Arbor vitæ seldom exceeds the size of a shrub, but in moist soils it becomes a large tree. In the wet clayey regions of America, especially those which are subject to frequent inundations, it becomes a timber tree, and, although a light wood, it is one of great durability. It is commonly known in commerce as *white* cedar, and is in much request among builders for cellar beams and posts, and for

piles in wet and trying situations. It seems to be a slow growing tree, for Michaux counted 277 concentric circles in a stem only twenty-one inches in diameter. The smaller branches and spray are made into besoms; and the leaves afford a salve which the Indians prize as a cure for rheumatism. Thuja articulata yields the gum sandrach of commerce; but that most esteemed is an exudation of the common juniper. Powdered gum sandrach is familiarly known as *pounce*, and is used for the purpose of preparing parchment for the pen.

(1435.) Of the Junipers, *Lycia*, *Sabina*, and *communis*, are the most important species. *J. Bermudiana*, *Barbadensis*, and *Virginiana*, are also valuable in the West Indies, as affording timber, which is brought to this country under the name of Bermudas Cedar. The last named is one of the highest timber trees of Jamaica; it yields large boards of a reddish colour, firm, shining, and very fragrant, and is hence much prized by cabinet-makers. *J. lycia*, by common repute, produces the gum Olibanum, which is supposed to be the incense of the ancients, and it is one of the gums employed by the Roman Catholics in their religious ceremonies, and used frequently to cover offensive odours in sick rooms. Olibanum, however, if yielded by the J. lycia, is not procured from it alone, another plant, the *Boswellia serrata*, being referred to by good authority, as the chief, if not the only source. J. Thurifera does not deserve its name, for it yields no frankincense at all.

(1436.) *J. sabina* is a powerful stimulant; but, although recommended as a diaphoretic and emmenagogue, yet as the Malthusian doctrines, although theoretically commended, are not practically enforced, it is seldom used except in the form of ointment to promote the discharge from blisters, or to cleanse foul ulcers and other unhealthy sores. The expressed juice of the leaves is said to be serviceable in the treatment of *tinea capitis*.

(1437.) *J. communis*, our only indigenous species, grows abundantly in most parts of Europe, and almost in any soil; granite rocks and sandy heaths, and fertile plains, appear almost equal to this plant. It is obnoxious to the growth of grass, none in general being found beneath it; but it is said that the *avena pratensis* will in turn destroy it. The wood of the Juniper is hard and durable, and its bark may be twisted into cables, but the chief use of the plant is to flavour ardent spirits. Hollands owe their taste to the so-called *berries* of the Juniper, and English gin is commonly believed to be flavoured with them also; but it is wholly unconscious of their presence, the British manufacturers of that 'cordial' poison being content with the substitution of oil of turpentine. Juniper berries are stimulating and diuretic, their properties depending on an essential oil which they contain: when boiled they yield a considerable quantity of sugar; and Linneus states that such a decoction, when fermented, forms a common drink in Sweden. From six to eight hundred tons are annually imported into this country, but the oppressive duty to which they are subject, full 100 per cent., limits their consumption.

(1438.) From cypresses growing most freely and luxuriantly in the Mediterranean isles, the temperature of which, from their situation, is remarkably equable, and the climate mild and healthy, these trees were formerly supposed to conduce to the salubrity of those countries, by purifying and renovating the air. Hence consumptive persons were sent to Candia and Cyprus, as places out of Attica where they had less chance to die. But, although labouring in the common occupation of withdrawing charcoal from the atmosphere, there is no evidence

that the cypress is more active than the other Pineales, although it is not improbable that the plants included in this order are, and have been, more energetic than any others save the Ferns.

(1439.) Both the leaves and the fruit of the cypress are bitter and astringent, and in old times were medicinally employed. Galen recommended their use to restrain various fluxes; but in the present day they are fallen into utter neglect. The common cypress has always been a favorite ornament in gardens, and the weeping cypress, from its melancholy aspect, devoted to the fellowship of the tomb. Its wood is not liable to be attacked by worms, and its durability is proverbial. Hence, according to Thucydides, the Athenians buried the bodies of their heroes in coffins of cypress wood, and from it, as not being subject to decay, they also made the statues of their gods.

The *Cupressus Thyoides* of North America is there called the white cedar, and it would seem that the timber of the European cypresses have often been likewise thus mis-named, which error may have led to a similar endurance being ascribed to the cedar which it does not in truth deserve. Thus Horace, in accordance with the popular opinion, attributes to its oil the power of ensuring durability:

——— "speramus carmina fingi
Posse linenda *cedro* et lævi servanda cupresso."

The imperishable chests that contain the Egyptian mummies were made of cypress wood, and the gates of St. Peter's church at Rome, which lasted from the time of Constantine to that of Pope Eugene IV. viz. eleven hundred years, were formed of the same materials, and had during that lengthened period suffered no decay.

(1440.) The cypress often attains a very large size; in Crete, Malta, and some parts of the Levant, it forms a common timber. In America also some examples are on record in which these trees have reached a most enormous magnitude. Thus, at Atlixo, there is a very ancient and remarkable cypress which is said to measure not less than seventy-six feet in circumference. The trunk is hollow, and the diameter measured inside is fifteen feet. But even this cypress, large as it is, shrinks almost into insignificance when compared with some individuals of an allied genus, now called *Taxodium* or *Schubertia*, the Cupressus disticha of Linneus.

(1441.) The Taxodium is a native of America, growing abundantly in the southern parts of the United States, and likewise in Mexico. In the gardens of Chapultepec is one called the Cypress of Montezuma, which was in full vigour when that prince was on the throne, in the year 1520. It is now forty-one feet in girth, and apparently only in its prime. But another, far more remark-worthy, is described by Exter, as standing in the burial-ground of *Santa Maria de Tesla*, which the inhabitants of Oaxaca call *Sabino*. There are several noble trees in the same place; the largest, however, is the vegetable wonder, measuring 117 feet ten inches (French) in circumference, thirty-seven feet and a half in diameter, and about one hundred feet in height. This patriarch of the woods was mentioned by Cortez, who encamped his little army beneath its shade; and it is regarded with reverence almost approaching to religious veneration by the native Mexicans. The height at which the admeasurements were taken is not mentioned; but, supposing them taken on the ground-level, there are several Taxodia mentioned by Michaux, as growing in the Floridas and Louisiana, which would nearly

equal the great tree of *Oaxaca*: for he says they gave forty feet in girth above a conical base three or four times as large as the columnar trunk. The mean age of the Taxodia has been calculated to be from 4000 to 6000 years; and if such computations be correct, which however is more than doubtful, the great tree of *Oaxaca* may be coeval with the creation. Or, as the poet says,

> "Its cold and lengthened tracts of shade
> Rose on the day when sun and stars were made."

TAXINÆ.

(1442.) TAXACEÆ. As in the two previous instances, the genera included in the section *Taxinæ* are all associated to form a single type, which, from the normal genus, is named Taxaceæ. There are, however, observable in this group three diversities of foliage, which, although perhaps not sufficiently important to be made typical characters, may be allowed to indicate three subtypes. Thus, in the Yew (*Taxus*), and its immediate allies, the leaves are acerose, in *Salisburia* they are flat and expanded, and in *Ephedra* they are absent; which variations may be taken as the differential characters of the *Taxidæ*, *Salisburidæ*, and *Ephedridæ*.

(1443.) The yew, of which we have but one, or at the most two, known European species, was formerly, before the invention of fire-arms, a most important

Taxus baccata.

B. Branch with fruit, and shewing the simple acerose leaves.

(*a*) Stamineous ament reduced to a monadelphous cluster.

(*b*, *c*) Upper and under view of the peltate antheriferous scale.

(*d*) Pistilline cone reduced to a single flower.

(*e*) Longitudinal section, shewing the naked ovule, the foramen, and the investing scales.

(*f*) Scales removed.

(*g*) Ripe fruit, shewing the ovules and half the succulent cupule, (or arillus?)

(*h*) Section of the seed.

(*i*) The nucleus.

(*k*) Section, to shew the embryo within the albumen.

(*l*) The embryo removed.

tree, as affording bows for our warriors; indeed, its very name, *Taxus*, is said to be derived from Τόξον, a bow; but yew is evidently a corruption of the Saxon *iw*,

green, and alludes to its sempervirence. So great was the demand for yew in the days of archery, that various laws were enacted concerning it from the time of the fourth Edward to the reign of Elizabeth. As our native produce could not supply the vast demand, it was imported in large quantities from abroad; and ships trading to Venice were obliged to bring ten bow-staves along with every butt of malmsey. The skill in the use of the long-bow was the proud distinction of the English yeoman, and it was his boast that none but an Englishman could bend that powerful weapon. By a statute of the fifth year of Edward the Third, every Englishman, and Irishman dwelling with Englishmen, was directed to have a bow of his own height; and it has been supposed that, to supply these arms, the yew trees so common in our churchyards were planted. This is, however, most unlikely, for in the first place the supply, from such sources, would have been far too scanty, and in the second, it is well known that the yew was in ancient times dedicated to religious purposes. Ray says it was planted by our ancestors, in churchyards, because as an evergreen it was thought to be a symbol of that immortality the dead hoped to enjoy. Branches of yew were likewise carried over the dead by the mourners, and thrown into the grave for the coffin to rest upon. The yew tree was also consecrated by the priests; and, by an extract from the ancient laws of Wales, it appears that the performance of the ceremony raised its value from fifteenpence to twenty shillings.

(1442.) The yew is one of the most tonsile trees we have; and hence, when the formal systems of horticulture were in vogue, yew hedges and yew images were in great repute. Few vestiges of this perversion of taste remain; between Henley and Oxford, however, there are two yew trees cut into the form of peacocks, and in Bedfont churchyard there are two others, which have now been upwards of a century and a quarter reduced to such an unnatural condition, their yearly shoots being annually clipped off; and there is no chance of escape for these metamorphosed trees, an annuity having been left by some eccentric person to keep these yews thus cut for ever.

(1445.) The wood of the yew is hard, heavy, and extremely durable. It is peculiarly adapted for floodgates, mill-dams, and other works in exposed and trying situations. Its knots, veins, and red colour, also render it a favorite with the turner and cabinet-maker.

(1446.) The yew is a very long-lived tree, and often attains an enormous magnitude. One in Braburne churchyard, in Kent, was nearly twenty feet in diameter; and at Sutton, near Winchester, there was (to use Evelyn's quaint language,) "such another monster." The Crowhurst yew, near Hastings, is thirty feet in circumference. The Fortingal yew, in Perthshire, when seen by Pennant, although reduced to a mere shell, was alive, and measured fifty-six and a half feet in circumference, or about eighteen feet in diameter; but in the woods of Cliefden there are some still more extraordinary remains of these trees; and one, called the Hedsor yew, still in health and vigorous, that measures twenty-seven feet in diameter, or about eighty-one feet in girth.

(1447.) The succulent coat of the yew-berry has a sweet and sickly taste; it is, however, wholly innoxious, although the seeds are said to be unwholesome. The leaves also are poisonous, at least to some animals; for, notwithstanding deer, sheep, and goats, are said to be able to feed on them with impunity, a very small quantity taken as food will destroy both cows and horses. Several fatal accidents,

shewing the poisonous properties of the yew-leaves, have within a short time occurred: in one of these, three horses, taken to be sold at a country fair, were tethered to the churchyard railings, over which some yew-boughs hung. The horses ate the leaves, and they all three were killed by their repast.

(1448.) On the authority of an Italian physician, it is stated that the yew-leaves, when administered in small doses to man, have a power similar to that of digitalis over the action of the heart and arteries, reducing the circulation, and, if persisted in for too long a time, or given in too large doses, to be as certainly fatal as foxglove. Yew is however reported to have one decided advantage over digitalis, by its effects not accumulating in the system; so that it is a much more manageable and equally efficient remedy. Such being the case, it is to be regretted that it has not been introduced into the British lists of medicines.

(1449.) The fruit of *Podocarpus nereifolius* is said to be eatable, as is also that of the Gingko (*Salisburia adiantifolia.*) The pulpy covering of the seed in this latter is, when ripe, of a bright yellow colour externally, with an inner, white, fleshy, juicy pulp. The kernel is white, rather firm and sweet, bitter if eaten raw, but agreeable in flavour when roasted. Dr. Abel informs us that he saw the fruit exposed for sale in the markets of China. It is a peculiarly interesting plant, as shewing, by the expansion of its leaves, an approach to the following class, as well as by their form and venation to the *Adianta* of the ferns.

Salisburia adiantifolia.

A. Terminal whorl of aments, with a central tuft of leaves.

(*a*) Ament.

(*b*) Pendent stamen.

B. Cutting, to shew the bilobed leaves, with linear dichotomous venation.

(1450.) *Ephedra*, which concludes this class, is still more interesting than Salisburia as an osculant genus; for the branches and branchlets are jointed, as they will be found to be in *Casuarina*, of the *Querneales*, and also, as they have already been described to be, in the Equisetine ferns. [§ 896.] Indeed, from

its great resemblance to these plants, it has usurped their old Greek name; for Ephedra originally belonged to the horse-tails, as Hippuris to the mare-tails, and of it Equisetum is but the Latin version. *Ephedra monostachya* abounds

Ephedra monostachya.

c. Cutting, to shew the leafless articulate branches, with nodal sheaths.

(*a*) A joint, with its sheath.

(*b*) An ament.

(*c*) A flower separated, to shew its scales.

(*d*) Monadelphous stamens, denuded.

in Siberia; and *E. distachya* occurs both in France and in the southern parts of Russia. On the shores of the Mediterranean their berry-like fruits are called "raisins de mer," and they are considered both tonic and febrifuge. In Hungary and Siberia the fruit of the E. monostachya is eaten as a luxury; and Gmelin states that, in his travels, he was only too happy when he found them. Carver mentions another species of Ephedra, found on the borders of Lake Michigan, in the country of the Chippeway Indians, that bears fruit as large as a marble, and is called "the sand-cherry." He says these are much relished by the French, who preserve them in brandy, and make a sort of ratafie.

(1451.) Here concludes the general outline of the Pinares or *gymnospermous exogenous dicotyledons;* but, besides these, which are well ascertained to have naked seeds, upon which character the class is chiefly, although not wholly established, Dr. Brown believes that even *Gnetum,* of which *Thoa* of Aublet is a species, has a similar conformation, and, although the seeds have three coats, that they are destitute of a true pericarpium. If further investigations should confirm this belief, then *Gnetum,* from its extreme difference of habit, will become the representative of another type or section, connecting the Pineales still more closely to the other Crescaffines, and which might be called the *Gnetinæ;* but, as botanists have in general regarded one at least of the coats referred to as a pericarpium, it would not be expedient at present to disturb the ordinary arrangement, nor, without more extended investigations, to associate these plants with the Pineales.

(1452). This summary outline of the most important genera included in the several types and sections, is closed, as usual, with a

TABULAR CONSPECTUS OF THE CLASS.

PINARES 1392	PINEALES 1401	Taxinæ, Taxaceæ (1405)
		Cupressinæ, Thujaceæ (1404)
		Abietinæ, Pinaceæ (1403)
	ZAMIALES	Cycadinæ, Cycadaceæ (1395)

GEOGRAPHICAL DISTRIBUTION OF THE PINARES.

(1453.) From the colossal size and majestic port of the majority of the trees included in this class, they form a striking and characteristic feature in the vegetation of all countries in which they abound, and their distribution is nearly universal. But their prominent station is attributable rather to the peculiarity of their aspect, and the multitude of coexistent individuals, than to their number of species and genera, which is much less than the average proportion.

(1454.) Topographically considered, the two orders included in this class differ greatly in their range; for, while some of the Pineales are polar plants, extending to the regions of perpetual snow, the few Zamiales with which we are acquainted, like the palms and arboreous ferns, that in habit they so much resemble, are exclusively the natives of warm latitudes, and scarcely to be found without the tropics.

(1455.) China, Cochin-China, the East Indies, New Holland, the Moluccas, and Japan, are the countries to which the several species of *Cycas* are indigenous. *C. revoluta* has the most northern habitat of the whole; but Japan, in which it occurs, has a climate almost peculiar to itself: and is much more tropical in its temperature than in its latitude.

(1456.) The *Zamiæ* and *Arthrozamiæ* are so diverse in their distribution, that it is fortunate subgeneric distinctions are indicated by their structure. The true *Zamiæ* are denizens of the Old, the *Arthrozamiæ* of the New World. Hispaniola, Florida, and the various West Indian Islands, with the tropical regions of Continental America, are the native habitats of the species *muricata, furfuracea, debilis, integrifolia, media, pygmæa, tenuis, angustifolia,* and *pumila*; the foliola of which are articulated to the rachis or midrib of the leaf: while of the true *Zamiæ* none are found in the Western hemisphere; but the majority of the species belong to Madagascar and Southern Africa, especially to the neighbourhood of the Cape of Good Hope; one only, *Z. spiralis,* having been discovered in New Holland. It is remarkable, that, although the American *Arthrozamiæ* are all tropical, none of the true *Zamiæ* are found in the equinoctial regions of Africa, notwithstanding they are natives of the southern parts of the Peninsula and of the island of Madagascar.

(1457.) The three types or sections of the order Pineales have each a nearly equal extent of distribution, the difference of habitat occurring rather among the species and genera than among the larger groups. Of the three, the Abietinæ may have perhaps rather the most northern and southern range, but at the same time several of the tropical genera and species belong to this section; while the *Cupressinæ* and *Taxinæ* are chiefly extratropical, and found for the most part in the temperate regions.

(1458.) *Dammara Australis* and *Araucaria Braziliensis,* are among the few

tropical species of the *Abietinæ*, to which may be added the *Cedrus deodara* of Hindoostan, as well as the other pines of India, several of which, however, from their altitude if not latitude, verge in climate towards the temperate zones.

(1459.) The *Cedar*, the *Aleppo*, the *Cluster*, and the *Stone-pines*, are natives of the south of Europe: Pinus maritima, Laricio, and Romana, of Italy and the shores and islands of the Mediterranean; while the majority of the Pines, Firs, and Larches, are most common in the northern parts of the temperate and in the frigid zones, of either hemisphere. Thus *Abies excelsa* occurs in Norway, Sweden, and Arctic Russia. *A. nigra, rubra, alba, Douglassii,* and *Canadensis,* in North America; the *Common Larch* in the northern parts of Continental Europe, even extending to Siberia; and the *red* and *black Larches* in North America.

(1460.) Of the true Pines, the Scotch, the pigmy, and the Siberia stone, are all northern plants in the Old World, while *P. strobus, Banksiana, palustris,* and others, overspread parallel latitudes in America, reaching as far north as Hudson's Bay. *A. alba* was the most northerly seen in Franklin's polar journey.

(1461.) Of the *Cupressinæ*, *Taxodium*, which is found in Mexico, and *Cupressus*, several species of which are natives of Goa, Nepaul, Candia, and Japan, are the least northern genera. The *Junipers* and *Thujas*, although a few, as the Barbadoes and Bermudas cedars, are equatorial plants, or confined to the warmer regions of the temperate zone, extend far north, even into Siberia, and the polar climates of America.

(1462.) The *Taxinæ* are chiefly found in the warmer parts of the temperate zones. Thus, *Salisburia* and the *Podocarpi* are natives of China and Japan, *Dacrydium* and *Phyllocladus* of New Zealand and Van Dieman's Land; but the Ephedræ extend from the shores of the Mediterranean to Siberia, while one of the Taxi is found in China, one in Canada, and the common species are distributed throughout Continental Europe, Great Britain, and Ireland.

(1463.) Hence it will appear that of the Pinares, statistically considered, the *Zamiales* is the tropical, the *Pineales* the extratropical order. For, although some of the latter are equatorial plants, the majority are found in cold and temperate latitudes, and the former are unknown in the northern temperate and polar regions.

(1464.) The tropical Pinares are chiefly the *Dammaræ*, *Araucariæ*, some few *Pini*, *Cedrus Deodara*, *Juniperus barbadensis*, *and Taxodium*. Bordering on the tropics in either hemisphere the number of the Pineales is greater than within five and twenty or thirty degrees on either side of the equator, and as the parallels of latitude become higher, the prevalence of these plants becomes more decided, until in the north temperate and frigid zones they reach their climax; for, although not the last arborescent vegetables found, they flourish almost on the verge of perpetual snow.

(1465.) Some points of interest belong to the distribution of these plants in similar latitudes in the Old and New Worlds, and on either side of the equator.

The restriction of the *Zamiæ* to the western hemisphere, and of the *Arthrozamiæ* to the eastern, has been already mentioned, as well as the peculiar exclusion of the latter from the equinoctial regions of Africa, notwithstanding their abundance in Madagascar, and at the Cape of Good Hope; and the prevalence of the allied Zamiæ in equatorial America.

In the same manner the Cycases are wholly confined to the eastern hemisphere, although some are found on either side of the equator.

(1466.) A nearly analogous exclusive distribution occurs frequently among the *Pineales;* few genera and species having a very extended range, and a great difference is found even in similar latitudes in the northern and southern hemispheres.

To the north of the equator the Stone pines, the Firs, the Larches, Junipers, Ephedræ, and Yews prevail; while to the south they are superseded by *Araucaria, Dammara, Podocarpus, Dacrydium,* and *Phyllocladus.*

(1467.) Between the eastern and western hemispheres, a similar but minor difference is observable as between the north and south: in the one the diversity being often in genera, in the other more frequently in species. Thus, in the Old World we find *Abies excelsa, picea, orientalis,* and *spectabilis;* in the New, *A. alba, nigra, canadensis,* and *Douglassi:* in the Old World *Larix europea,* in the New *L. pendula* and *microcarpa;* in the Old World *Pinus sylvestris, Pinea, Pinaster,* and *halepensis;* in the New *P. Strobus, Tæda, serotina,* and others; in the Old World, Thuja orientalis: in the New, Thuja occidentalis, and similar illustrations might be given of the *Junipers* and of the *Cypresses,* but in this latter group the difference is generic, *Cupressus disticha* being now called *Taxodium.*

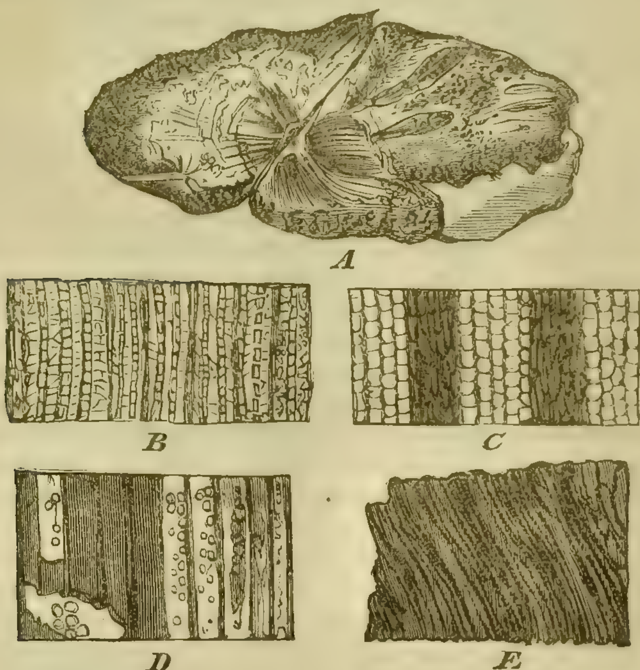
(1468.) The extensive range of the Pineales, and the vicarious presence of the order by equivalent genera and species in both hemispheres, would seem to bespeak its importance; and, next to those which afford his staple food, there is none that is more universally and immediately serviceable to man. On a rough calculation perhaps four-fifths of the timber used in domestic architecture is derived from these plants, and they likewise afford a large proportion of that now employed in ship and boat building, and in the construction of household furniture. The tractability of most, and the extreme durability of many of the pineal woods, fit them for numerous works of art, and recommend them strongly to general favor. As a source of revenue it is not unimportant, for the duties paid on pine timber alone brought into our ports from foreign parts, amounts to nearly a million and a half per annum.

(1469.) As dietetic plants the Pineales do not hold a very exalted rank; for, although the seeds of many are eatable, and the fruit and leaves of a few are not to be despised, as food, and although in barren countries the bark of some is made into bread, still these are uses which, great as may be their value in peculiar situations, are on the whole of secondary importance; but the secretions of the pines are valuable indeed, both as medicines and in the arts, as the immense consumption of their various balsams, resins, turpentines, and tars, and the innumerable purposes to which they are applied, sufficiently declare.

GEOLOGICAL DISTRIBUTION OF THE PINARES.

(1470.) Since, by the labours of Witham, the intimate structures and textures of fossil plants have been disclosed, and his mechanical contrivances have enabled the botanist to examine and note their anatomical peculiarities with almost as much facility as in the case of recent vegetables, the affinities of many ambiguous

relics have been made out, their differences and identity established, and sometimes even their degree of approximation to existing species satisfactorily shewn;



A. Lennel Braes-tree, *Pitus antiqua.* Transverse section, containing vestiges of organic structure, although in part disorganized, and spaces filled by crystals of extraneous matter. The centre consists of calcareous spar, and the lighter rays proceeding from it of the same; certain organic portions also radiate from the centre, and are lost in the apparently cellular masses of the circumference. The seeming cellular external mass is not organic, but consist of crystals of calcareous spar; in it, however, are organic portions that run lengthwise, continuously, through the mass.

B. Part of one of the organic relics highly magnified, to shew its regular woody texture and medullary rays.

C. Transverse section of the Tweedmill fossil-tree, *Pitus primæva*, shewing its very broad medullary rays.

D. Coal, from the Northumberland limestone series, shewing elongated cellules in a longitudinal section parallel to the medullary rays.

E. Fragment of Bovey coal, which, from its distinctly stratified texture, is indisputably the remains of an exogenous plant, and probably of one of the Pineales, and named by Witham, *Pinites carbonaceus.*

and this by means as simple and unhoped for, as the evidence afforded is conclusive and direct.*

* His method of preparing fossil plants for microscopic observation is thus briefly described by Mr. Witham: "A thin slice is first cut from the fossil wood, in a direction parallel or perpendicular to the fibres. It is ground flat and polished on one side, which is attached by means of Canada-balsam to a piece of plate-glass, after which it is ground down to the necessary degree of thinness, and polished. By this means the internal structure may frequently be as distinctly seen as in the slice of the recent vegetable."

(1471.) On the former history of no class have the researches of Witham and his coadjutors thrown more important light than on the present, and valuable accessions are being daily made to our knowledge of the ancient allies and representatives of the *Pinares*.

(1472.) Five years have scarcely yet elapsed since the highest authority in this department of natural science expressed something more than a doubt of the existence of coniferous plants in the coal era, whereas it is now proved beyond cavil that representatives of such plants not only did exist, but that they formed an essential and prominent feature in the vegetation of the epoch referred to; and this change of doctrine has been wrought not more by the discovery of new fossils than by a better acquaintance with the old.

(1473.) Representatives of both the *Pineales* and *Zamiales* are found in a fossil state, and not only representatives of these two at present existing orders of the *Pinares* have been discovered, but indications of other allied groups, probably now extinct, which appear to have been transitional between the *Firs* and *Ferns*, and to have associated more closely than recent examples do, these two essentially diverse and yet curiously similar classes.

(1474.) Both the existing genera, *Zamia* and *Cycas*, have representatives in a fossil state. Of the former sixteen species have been discovered, twelve of which are so like to those at present existing, that they are included in the same genus, and enjoy the same denomination as the recent plants. The remaining four, although closely allied, differ in the exsertion and venation of their leaves, and hence their affinity and diffinity are marked by their derivative generic name, *Zamites*. Of these sixteen species fifteen have been found in the Lias and Oolitic formations; the precise locality of the sixteenth, *Z. Buchanani*, brought from the East Indies, is unknown.

(1475.) Some fossil leaves discovered in the lower chalk-beds in Sweden so strongly resemble the modern cycases, that Brongniart has formed a genus for their reception called *Cycadites*, and the only species as yet known he terms *Nilsoniana*, in honour of the finder.

(1476.) Two fossil stems resembling those of Zamia have been found in the Portland-stone. Dr. Buckland, who described and figured them in the Transactions of the Geological Society of London, proposed to call them *Cycadeöideæ*; but, as they rather resemble Zamiæ than Cycades, Brongniart has changed the name to *Mantellia*, dedicating them to our well-deserving countryman Gideon Mantel. He also includes in the same genus another stem found in the shelly limestone near Luneville, and which, as it appears to resemble *Cycas* as much as the other do *Zamia*, had perhaps better assume their discarded name, *Cycadeöidea*.

(1477.) Besides these immediate allies, other fossil remains have been discovered, which, although not so closely similar to the at present existing Zamiales as the foregoing, are still evidently referrible to this group. These occur in the lower Oolitic beds and in the variegated marl and sandstone of the Lias. Eight of these species are included in a genus called *Pterophyllum*, and the remaining two in another termed *Nilsonia*. The gyrate vernation peculiar to the *Ferns* and *Cycadaceæ*, is very evident in the fragments of the two last named genera.

(1478.) Of the Pineales the vestiges are more abundant than of the preceding order, representatives having been already found of the *Yew*, *Ginkgo*, and *Podocarpus*; *Cypress*, *Juniper*, and *Thuja*; *Pinus*, *Abies*, and *Araucaria*, as well as

other less closely associated genera at present perhaps extinct, such as *Peuce, Pinites,* and *Pitus,* with the questionable *Brachyophyllum* and debateable *Lepidodendra.*

A. Craigleith fossil-tree of 1830, (Pinites Withami,) forty-seven feet long, and diameter at the base five feet by two feet, and at the broken off small end one foot seven inches by one foot four inches. B. Araucaria perigrina, (*L.* and *H.* 88.) C. Sphenophyllum erosum. D. Sphenophyllum Schlotheimii. (*a*) Leaf of Salisburia, to shew its resemblance to the fossils.

(1479.) Five species of fossil plants occur in the tertiary beds and one in the Oolites, which so strongly resemble the yew that they have been called *Taxites;* and a curious fossil has been found at Aix, in the fresh-water beds of the tertiary series, that has been referred to the genus *Podocarpus.*

(1480.) The affinities of the eight species of *Sphenophyllum,* discovered in the coal series, are not so unquestionable. Brongniart associated them with the *ferns,* likening them to the *Marsiliaceæ,* but he was probably misled in his judgment by the then current doctrine that the Pineales were not to be found in the carboniferous strata, in which ferns were known to be abundant; and the authors of the Fossil Flora with much more apparent justice refer these fossils to the vicinity of *Salisburia,* one of the *Taxinæ,* [§ 1478, C, D, *a.*]

(1481.) The primæval Cupressinæ already known are, first, the doubtful *Brachyophyllum mammillare* found in the lower Oolite, three species of *Juniperites* in the tertiary strata, one species of *Cupressites* in the new red sandstone, three or four species of *Thujites* in the Jura schist, and several species of *Thuja,* not generically differing from the present existing plants, amongst the lignites of the tertiary series.

(1482.) The prototypes of the section *Abietinæ* are the following. The *Voltziæ*, of which four species have been found in the new red sandstone: these fossils are likened by Brongniart to the southern *Araucariæ*. One species of *Abies* called *Laricioides*; nine species of *Pinus*, among the lignites, and in the different strata of the tertiary series; and several species of *Peuce*, *Pinites*, and *Pitus*, in the Lias, Oolite, and the coal formations; the latter two being genera structurally different from any known existing plants, although clearly allies of the *Abietinæ*. These fossil *Pineales*, as Mr. Witham observes, "evidently pass into each other by a regular gradation, and therefore in all probability belong to the same natural family. *Peuce* is obviously a conifera, and the others differ only in circumstances which do not seem very important. Thus *Peuce* has the woody tissue very distinctly divided by concentric circles, while in the other genera these circles are occasionally present, but more frequently absent. In *Peuce* the pith is not larger than in our recent coniferæ, but in *Pinites* it is at least four times the size. The walls of the woody tissue of our recent *pines* are marked with single series of separated areolæ, seldom occupying their whole breadth; those of *Peuce* are also marked with single series of precisely similar areolæ, but some of them have also double series. In *Pitus* the areolæ are always in double or triple series, although still separate, and usually roundish. In *Pinites* the areolæ are hexagonal, contiguous, and arranged in two or more series."

(1483.) A curious fossil found in the mountain limestone series, at Allenbank, in Berwickshire, and called by Mr. Witham *Anabathra pulcherrima*, from the extreme regularity and beauty of its ladder-like cellular structure, has, according to its discoverer, some resemblance to our recent Coniferæ; but he does not venture absolutely to decide on its relationship. That it is an exogenous plant appears evident from its having "a regular pith," and that it is associable with the *Pineales* rather than with any other order seems probable from "the tissue between the pith and the surface, which is composed of elongated cellules, or woody fibres, remarkable for their extreme regularity, being disposed *precisely like those of our recent* Coniferæ, but without indications of concentric circles." This opinion is further corroborated by the medullary rays which are present being "extremely sparse, and remarkable for their small size." On a transverse section they present an elliptical form, and the walls of the elongated cellules are marked all round with very regular, close, horizontal lines.

(1484.) The similarity of the *Lycopodiaceous ferns* with certain tropical *Pineales*, such as *Araucaria excelsa*, the Norfolk-Island pine, and others, and especially of the gigantic fossil *Lycopodites*, and *Lepidodendra*, has been often dwelt on; and Brongniart, when denying the presence of the Pineales in the coal formation, qualifies the denial by referring to these fossils as the most likely of any to furnish exceptions to his rule, (Prod. p. 175.) This half-prophetic hint has but lately been shewn to have been not an idle speculation: it is true that other coniferous plants had been previously shewn to be abundant in the carboniferous strata, and that the Lepidodendra have not been absolutely proved to belong to the order Pineales; but the anatomical structure of one species, viz. *L. Harcourtii*, which has been examined by Mr. Witham, and subsequently by Messrs. Lindley and Hutton, demonstrates that it at least, if not other Lepidodendra, approaches very closely in its internal organization to the pines; and whether it be proved to be a flowering or a flowerless plant, it will equally be-

come a further band of union, and connect the two classes, firs and ferns, still more closely. Witham, in his treatise on fossil vegetables, inclines to its arrangement with the Lycopodiaceous ferns, but the authors of the Fossil Flora seem to believe it more nearly related to the pines. The twofold affinities of this interesting fragment have been well described and discussed in both the works referred to, in the latter of which the following summary is given: "It had a central pith, it had a vascular sheath surrounding that pith, and it had fistular passages in its cortical integument; thus far it was coniferous. But no trace can be found of glandular woody fibre; it can scarcely be said to have had any wood, and it is uncertain whether it had bark." "Its vascular system was confined to the middle of the stem, and to the curved passages emanating from it; the stem consisted chiefly of lax cellular tissue, which became more compact towards the outside, and it had a very powerful communication between the bases of its leaves and the central vascular system; thus far it was Lycopodiaceous. But recent plants of the latter tribe have no fistular cavities in their cortical integument, a point of great importance, because such cavities indicate the presence of resinous or other secretions which are never found in *Lycopodiaceæ;* and secondly, the latter have no vascular sheath surrounding pith, which, if not an absolute sign of exogenous structure, is a very near approach to it."

(1485.) Such are the chief plants associable with the *Pinares*, vestiges of which have been found in a fossil state, and their epochs of existence reach from the coal to the upper tertiary formations, an extent of duration only of late conceded to this class. It now seems strange, the fact of their primæval existence being established, that the discovery was not made before, or at least, the chemical constituents of coal being known, their similarity with the products of the *Pines*, and their utter dissimilarity from those of the *Ferns*, being equally notorious, it does seem strange that the production of coal should have been almost exclusively attributed to ferns, and their allies, while the resinous Pineales were believed to be wholly absent from the beds of this bituminous fossil. For, although ferns occur in immense abundance in certain beds, as in those of Newcastle, Durham, and Yorkshire, still, when it was found in others, as in those of the Edinburgh and Lothian basins, consisting of thirty-three seams, the impressions of ferns are so rare as to be reckoned curiosities, it does seem strange that, while the impressions and remains of vascular cryptogamic plants were revealing the history of their former existence, so many magnificent members of the Phanerogamic classes should, as Witham well observes, have been allowed to lie speechless in their early graves, instead of proclaiming the antiquity of their origin and the usefulness of their order. But they are speechless now no longer; their graves have yielded up the dead; science has reanimated each lifeless corse, and given tongues to these once dumb mouths, which tell to the astonished and half-disbelieving world many a tale of wonder.

(1486.) From the preceding data it will be evident that the epochal, or as it were statistical, distribution of the fossil Pinares, is strictly coincident with that of the other classes, and hence it is to be presumed that the general laws which regulated the disposition of the one likewise influenced the geological relations of the others.

(1487.) Thus the fossil remains of *Thuja*, *Pinus*, and *Podocarpus*, are all confined to the tertiary strata. The *Juniperites*, and five species of *Taxites*, also

belong to the same series; while *Cupressites*, the tropical *Zamiæ*, and *Voltzia*, the representative of *Araucaria*, are the fossils of the secondary beds. The extinct species, the furthest removed from recent plants in their structure, are in general also the furthest from them in their geological position. For example, the *Cycadites* occur in the chalk, the *Mantelliæ*, in the Portland stone, the *Nilsoniæ*, and *Pterophylla*, in the marl and limestone of the Lias, and the lower Oolitic beds. *Peuce*, the most like of the extinct *Abietinæ* to existing species, is found in the Lias and Oolite only, *Pitus antiqua* and *primæva* in the mountain limestone, *Pinites* in the mountain limestone and the coal seams, and the ambiguous *Sphenophyllum* in the coal formation likewise.

(1488.) But not only are the nearest fossil allies of recent plants found in the more recent series, and their more remote associates in the older strata, but the analogies when traceable, are chiefly to existing tropical species, as *Zamia*, *Cycadites*, *Mantellia*, &c. to the *Zamiales*; the *Voltziæ* of our British red sandstone to the *Araucariæ* of the southern hemisphere; and so forth.

(1489.) Even the development of the stem yields other curious food for speculation. It is well known that, in the exogenous trees of warm countries the concentric strata are not so decidedly marked as in the timbers of cooler climes, and often, as in the mahogany and other equinoctial woods, the annual growths are undistinguishable, and the well-defined laminated circles are wanting altogether. Again: it is equally well known that the plants of hot moist regions, such as the swamps of tropical America, are not only very rapid in their growth, but their cellular structure is usually much developed, the cells large, and the texture loose. Even in temperate latitudes warm damp summers favor the growth of wood, and in such seasons broader annual layers are produced than in cold and dry ones.

(1490.) These are circumstances which have not escaped the acute and observant Witham. He notices that "the cells of the fossil coniferæ are generally much larger than those of our present trees of the same family." That in them, especially in the most ancient fossils, the pith is voluminous, and the medullary rays often composed of three, four, or five series of cellules, while in the existing species the plates are thin and the pith exceedingly small.

(1491.) Again, the concentric layers of many fossil vegetables exhibit "the same irregularities as those of our present trees, some of them being much broader than others. An inference to be drawn from this circumstance is, that the climate which existed at the epochs when these vegetables grew, resembled ours in the irregularity of its successive summers. If at the present day a warm and moist summer produces a broader annual layer of wood than a cold or dry one, and if fossil plants exhibit such appearances as we refer in recent vegetables to a diversity of summers, then it is reasonable to suppose that a similar diversity formerly prevailed. The remark, however, continues Witham, applies only to the plants of the Lias and Oolite, and the eras in which they flourished. For the *coniferæ* of the coal formation and mountain limestone group have few and slight appearances of the lines by which annual layers are separated; which, as already stated, is also frequently the case with the trees of our present tropical regions. "It is therefore possible that at the epochs of these formations the changes of seasons, as to temperature at least, were not abrupt;" and it is more than probable, other

circumstances considered, that the average temperature was high, the reduction rarely if ever great, and the atmosphere burdened with aqueous vapours.

(1492.) The barren rocks and proverbially sterile soil on which many of the Pineales alone will flourish, and the swampy districts in which others the most abound, are circumstances well deserving attention. The dismal swamps of America are overrun with cypress and fir, the rocks and hills of Europe and of Asia are crowned with gloomy forests of pines. On the sandy plains, the chalky downs, and even in the slaty trap and the granite districts, from the equator almost to the poles, Juniper will flourish, where nothing else will grow. Such plants, it is evident, do not draw greatly for sustenance on the soil. They were therefore well fitted to form a prominent part of the flora of those epochs in which vegetable mould was scarce, when the surface of the globe consisted chiefly of barren emerging rocks and extensive swamps. Such plants as these were fit fellow-labourers with the ferns to withdraw the superabundant carbon from the air, and to convert the aërial poison into wood, turpentine, and resin, whence that bituminous mineral called coal has been derived.

The growth and destruction of pine forests, the formation of peat, and the conversion of vegetable matter into lignite, jet, and coal; the separation of the coke from the Asphaltum, the Naphtha, and the various kinds of bitumen and mineral tar; with the application of these numerous products and educts in the arts, are paragraphs in one of those wonderful chapters in the history of the world which man is but beginning to translate.

OUTLINES OF ROSAROLOGIA.

(1493.) Linneus, Haller, Hill, and others, who have recognised the distribution of the vegetable kingdom into subordinate regions and natural provinces, or classes, after distinguishing the *Mushrooms*, *Flags*, and *Mosses;* the *Ferns*, *Grasses*, *Palms*, and their allies; seem to have found the bulky remainder untractable, and its arrangement to require a departure from their first established principles, and the adoption of an especial and more artificial scheme.

(1494.) But some difficulties which were then insuperable have since been overcome, and others dependent on the then imperfect state of physiology, are now in a great part removed: a further advance of knowledge has likewise shewn that the balance, although really large, which could not be included in either of the first six classes, and hence was crowded into the latter two, termed by Linneus *herbs* and *trees*, and by Hill denominated *plants*, is not so disproportionate as it then appeared; and, as science extends, it will probably become still less so. The false estimate then made was owing, in the first place, to many of the more common and familiar plants being referred to these non-conforming groups, and in the second, to the other classes having then been far less examined, and their extent being comparatively much less known.

(1495.) The *Algæ*, *Fungi*, and *Musci*, associating to form the *Mycaffines*, or first great region of the vegetable reign; and the *Filices*, *Gramina*, and *Palmares*, the second, or *Termaffines;* the *Plantæ* of Hill, or the *Herbæ et Arbores* of Linneus, will of course be included in this, the *Crescaffines*, which is the third, and last.

(1496.) Current terms should in general be preferred, and in-

novations in nomenclature as far as possible avoided; but occasions do occur when the most familiar words, from their signification having become indeterminate, are the most improper. Hence neither the old names nor the old distribution, although frequently preserved in the preceding classes, can be continued here, for *plant* has long since become a synonyme of vegetable; and herbs and trees are relative terms used indifferently throughout the whole domain, to distinguish the larger perennial from the smaller and more transitory species: and are therefore unfit denominations for any special groups or classes.

(1497.) One part of this extensive region has been already shewn to be structurally different from the rest, and all those plants which agree in having exogenous stems and naked seeds have been associated with the pine, to form the class *Pinares*. Another, but smaller group, will be found to be flowering cellular plants, and will form the ninth, and last class; of which more hereafter. But the intermediate province, which is by far the most important and extensive, containing the oak, the bread-fruit, the pepper, and the spurge; the rose, the vine, the poppy, and the flax; the olive, the coffee, the potatoe, and the thistle, with the very numerous allies of each, forms this, the second class of the third region, which is the eighth of the entire series.

(1498.) The general structure of these plants is similar in most points to that of the Pinares. The stem is tubivascular and exogenous; bark, wood, and pith, with medullary rays, being fully developed, and the yearly growths distinctly stratified. The external form of the trunk is conical, not cylindrical, and branched, not simple. The leaves are articulated with the stems or branches, the embryo possesses two or more opposite cotyledons, and the radicle is naked.

(1499.) But, although thus accordant with the associated Pinares in many particulars, there are others of no slight importance, in which the plants forming this eighth class differ from those included in the preceding. For example, the arborescent stems are more constantly conical and branched; the venation of the leaves is reticulate, not linear; floral coverings are developed, and for the most part in quinary series; the seeds are enclosed within seed-cases, constituting oftentimes elaborate fruits; the cotyledons are rarely more or less than two, and the radical is discrete as well as destitute of coleorhize.

(1500.) From these various structural peculiarities various names have been derived: by some botanists, as by Richard, from their distinct and naked radicle, these plants have been called *Exorhizæ;* and by others, from their seed-vessels, *Angiospermous Exogenæ*, or *Dicotyledons. Fruges* and *Eucarpæ* are both terms having reference to the evolution of the pericarp, and its frequent high development as fruit; but ROSARES, a derivative of *rose,* one of the best known genera, and one in which all the essential characteristics are eminently conspicuous, will form perhaps a more familiarly sounding, and perhaps a preferable collective name.

(1501.) Differentially considered, the ROSARES are angiospermous, exogenous, tubivascular plants, with reticulated leaves, exorhizous embryos, and usually two-lobed seeds.

(1502.) The numerous types or families into which the genera included in this class have been associated are distributable into three chief orders, relatively distinguished from each other by the evolution of the floral coverings. In one group, of which the lilach, the olive, the primrose, and the foxglove, are examples, the essential organs of the flower are invested with two series of coverings, a calyx and corolla; the pieces of the latter being conjoined, and forming, as in the *Syringa* and its allies, a tube, a bell, or a disk. In the second group the floral coverings are both present; but the pieces of which the corolla is composed remain distinct, or are very slightly adherent, as in the rose and the mallow. In the third group the corolla is wanting, the calyx being alone developed, and often even that single covering becomes abortive, and the flowers are absolutely naked, as in the oak, the chesnut, the hazel, and the pepper.

(1503.) From the *Oak*, the *Rose*, and the *Lilach*, the best known normal genera, these orders have been named respectively SYRINGALES, ROSALES, and QUERNEALES; and, as each comprehends an extensive series, they might severally form independent branches of inquiry; and, just as Algologia was distinguished into *Confervologia*, *Fucologia*, and *Lichenologia*, so likewise this department might be distributed into three subordinate sciences, of which the first would be *Querneologia.*

(1504.) As in those cases in which the organs are few in number, the individual plants, although numerous, are reducible to a comparatively small number of sections; and, as the organs become more numerous, and their combinations more various, the

number of the sections considerably increases; so will it be found that in these orders, where the organs are evolved to the utmost, and the most varied in their developments of any in the whole vegetable kingdom, nay, almost as much so as in all the other classes and orders put together, the groups distinguishable will be much more numerous, although the characters may often be far less decided; and the species fewer, although the individuals included may be much more abundantly produced.

(1505.) Still, as among these plants the organization is more complex, so the products are more various: the simple machinery of the Algæ and the Musci form but few and simple substances profitable either as food or physic; the more highly developed grasses furnish starch, gluten, and sugar in abundance; the still further advanced Palmares give various luxuriant fruits, and some extraordinarily potent poisons; but it is reserved for the Crescaffines, and especially for the Rosares, in which the internal structure is more complete, and the external organs more numerous and elaborately evolved, to produce all that infinite variety of herbage, fruit, and flowers, which chiefly adorn both forest and garden, supply food for building, hemp and flax for wearing, fruit and vegetables (pre-eminently so called) for food, and four fifths of the medicines that plants so liberally yield for the relief of sickness.

(1506.) Hence the difference in the qualities of the plants that are here allied has naturally confirmed, and even extended, the numerous sections and subsections which their differences in structure have not always obviously suggested. These, which amount to above two hundred minor groups, would be a burden to the memory, if the ultimate analysis were at once pursued,but they become with comparative ease remembered when the progressive alliances are retained in view as the intermediate stages of association: and, although the present state of knowledge does not warrant the assumption that all the minor types and major sections are strictly natural groups, still they are approximations towards such a desired system, and their convenience renders their use expedient.

(1507.) The smaller families or types here given are identical with those established by the chief authorities of the age; and the larger and more comprehensive associations are introduced to facilitate the acquisition of the others; and if in classes, such as the Palmares and the Ferns, so comparatively small, the

utility of the gradual synthesis has been evident, shall its aid be rejected here, when the extent of the class is so much greater, and its subordinate demarcations, like the political divisions of a well-peopled province, so much more numerous, and especially when, from the diversity of the properties and powers of the plants included, their discrimination becomes often so much more important?

QUERNEALES.

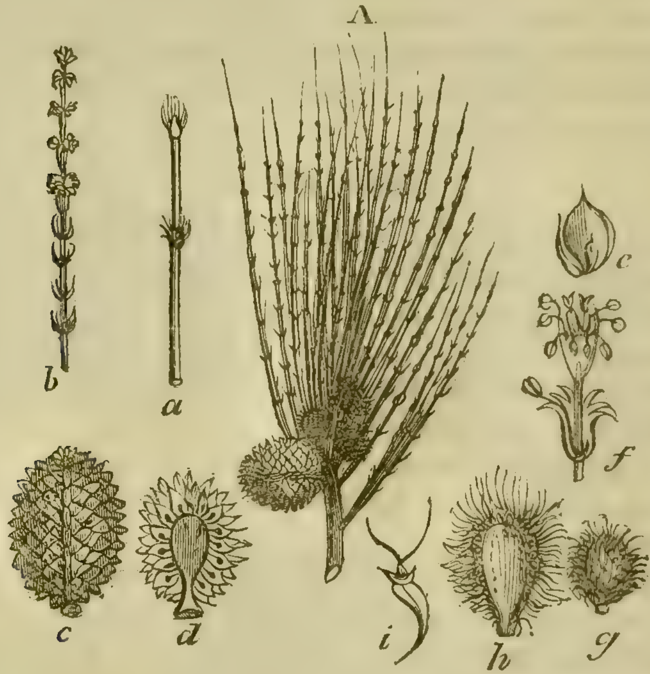
(1508.) Plants agreeing with the oak in certain general characters, of which the chief is their apetalous flowers, are associated to form the order QUERNEALES. Of these, the *Oak*, the *Elm*, the *Nettle*, and the *Laurel*, the *Pepper*, *Asarabacca*, and *Mare-tail*, with the *Dock* and the *Euphorbia* or *Spurge*, may be cited as examples: they are, however, not only examples of the order, but also the normal genera of the provisional sections into which it may be divided, each including several types, or families, of associated genera.

(1509.) The Querneal sections are nine in number, and of course are named, as heretofore, from the most important or familiar plants they respectively comprehend, and which are those enumerated above. Hence they will be called *Quercinæ*, *Ulminæ*, *Urticinæ*, *Laurinæ*, *Piperinæ*, *Asarinæ*, *Hippurinæ*, *Rumicinæ*, and *Euphorbinæ*.

(1510.) QUERCINÆ. The Quercinæ are exalbuminous Querneales, with amentaceous separated flowers; and hence this section is nearly equivalent to the *Amentaceæ* of the older writers; but the minor modern orders into which it has been divided, although well distinguished from each other, should not be dissevered, and they are here associated as the several types or families of a common section. The Casoar (*Casuarina*), the Gale (*Myrica*), the Willow (*Salix*), the Birch (*Betula*), the Hazel (*Corylus*), and the Walnut (*Juglans*), are the normal genera of these types, which hence are named the *Casuarinaceæ*, *Myricaceæ*, *Salicaceæ*, *Betulaceæ*, *Corylaceæ*, and *Juglandaceæ*.

(1511.) CASUARINACEÆ. The Cassowary or Casoar-tree (*Casuarina*), so named from a fancied resemblance its branches bear to the plumage of the emu, and called likewise by the South Sea islanders, from the use they make of it in the construction of their weapons, by a name signifying *Club-wood*, and by the Malays *Filao*, has much the appearance of a gigantic horsetail, and, like *Ephedra* among the *Pineales*, seems a departure or retrogression from the normal characters of the

plants with which it is associated for the purpose of establishing a connexion with the Equisetine ferns, and not abruptly passing from one section to another. The port of these trees is very remarkable, and especially that of *C. equisetifolia*,



A. *Casuarina quadrivalvis.* (*a*) Branchlet enlarged, to shew the nodi, vaginæ, and internodia. (*b*) Spiciform ament of monandrous flowers. (*c*) Strobiliform fruit when ripe. (*d*) Section of the same. (*e*) One carpel isolated. (*f*) Two whorls from the stamineous ament, to shew the exsertion of the stamens. (*g*) Strobiliform ament of pistilline flowers. (*h*) Section of the same. (*i*) A pistilline flower isolated.

which rises to the height of fifteen feet and upwards, and spreads its main branches freely on every side, from which hang down their finer divisions in bunches like horsetails. The branches and branchlets are articulated throughout, with sheaths surrounding the articulations, and the intermediate spaces grooved or striate, which characters (so much a repetition of Equisetum,) distinguish this type, called the *Casuarinaceæ,* from the *Myricaceæ,* the following group, often associated with it.

(1511.) The *Casuarinæ* are peculiarly interesting plants, as forming the transitional series from the Pineales to the present order. Until the ovules of the Pinares were shewn to be naked, and those of the Casuarinæ invested with pericarps, these plants were sometimes associated with the Amentaceæ, which they resemble in their mode of inflorescence; and at others with Ephedra, to which, by their leafless articulate branches, they bear no slight similitude. Indeed, the analogy is perfect between both these genera, which, with Equisetum of the ferns, form one of those extraordinary osculations in which plants essentially diverse in their organs of fructification exhibit a strong resemblance in other particulars; and,

were it not that the *Equiseta* are flowerless, the *Ephedræ* naked-seeded, and the *Casaurinæ* anglospermous plants, their articulated branches, destitute of leaves, would have seemed to indicate their union as an order.

(1513.) The *Casuarinaceæ* are much branched trees, with verticillate branchlets, the nodi disarticulating as in Equisetum, and surrounded by many-cleft or toothed vaginæ, from within which the successive shoots arise; the internodia are grooved and striated.

The flowers are separate, either monœcious or diœcious, and collected into terminal spiciform aments. The stamineous flowers are surrounded with many-toothed vaginæ, the perianth (?) four-leaved and chaffy; the stamen solitary, filament awl-shaped, anther erect and two-celled, dehiscing by a longitudinal chink; the connectivum obsolete.

The pistilline flowers are crowded into dense subovate spikes, or aments, the articulation being obsolete, and the perianth wanting.

The germen is lenticular, the ovule solitary, erect, and with a foramen at its apex. The styles two, and inferiorly connate. The fruit is winged, invested with thickened bracteolæ; the seed solitary, erect, and exalbuminous; and the embryo inverted.

(1514.) Differentially considered, the Casuarinaceæ are angiospermous exogenæ, with articulate leafless branches; amentaceous flowers, free germen, solitary erect ovules, and exalbuminous seeds.

(1515.) The *Casuarinæ* are chiefly Australian plants; thirteen species are known, six of which have monœcious, and seven diœcious flowers. The wood of several is hard and dense, and may probably become valuable in the market as timber; hitherto, however, it has been but little used except by the natives to form their clubs and other warlike weapons, for which, by its density and hardness, it is peculiarly adapted. Ainslie states that the C. equisetifolia is astringent, and is administered medicinally by the Javanese. This species was introduced by the first Lord Byron.

(1516.) Casuarina is the only known genus belonging to the type, but so peculiar is its structure, that it would be abnormal, if combined even with its nearest allies.

(1517.) Myricaceæ. The *Gales* and candleberry-myrtles, so called from their waxy exudations, which, when collected, are made into soap and candles, are well-known plants both in Europe, Africa, and America; and are associated with their immediate allies, *Comptonia* and *Nageja*, to form the present type.

(1518.) The *Myricaceæ* are either shrubs or trees, with round scattered exarticulate branches, the leaves alternate, simple, or pinnatifid, with or without stipulæ, penninerved, and for the most part entire, though sometimes serrate.

The flowers are monœcious or diœcious, and collected into aments.

The stamina are two or more, arising from the axillæ of a single hypogynous scale, the filaments are free or monadelphous, and the anthers two-celled.

The pistilline flowers are surrounded by several hypogynous scales. The germen is free, lenticular, and one-celled, and the ovule solitary. The style single, and the stigmata two, long, and filiform. The pericarp is dry and indehiscent, membranous, and winged at the edges; sometimes falsely drupaceous, from the scales with which it is covered becoming succulent and fleshy. The seed is

erect and exalbuminous, and the embryo, which is large, inverted, the short radicle being superior.

Myrica arguta.

c. Branch, shewing the alternate leaves and amentaceous flowers.

(*a*) Stamineous flower separated, shewing its bractea and monadelphous filaments.

(*b*) Pistilline flower, with its hypogynous scales and two filiform stigmata.

(*c*) The fruit.

(*d*) The calycine leaflet.

(*e*) Section of the fruit, shewing its winged edges and erect seed.

(*f*) The seed.

(*g*) The embryo denuded.

(1519.) Differentially considered, the Myricaceæ are *Quercinæ*, or amentaceous exalbuminous Querneales with foliose exarticulate branches, one-celled ovaries, and erect solitary ovules.

(1520.) The *Myricaceæ* are both astringent and aromatic. Our common *sweet gale* (M. Gale) is prized by country people for its agreeable odour. It is also said to be inimical to vermin, and hence its use in decoctions to destroy fleas, and other similar pests of the body and the bed; as well as to cure the itch. An infusion has also been recommended as a vermifuge. Myrica sapida bears a fruit about the size of a small plum, having a pleasant refreshing subacid taste, and, according to Buchanan, it is eaten in Nepal. The root of M. cerifera is a powerful astringent, but it is more prized for the wax it bears than as a medicine; and in some parts of North America, where animal tallow is scarce, its annual crop of wax is collected and made into candles. Our common gale yields wax, but much less abundantly.

Comptonia asplenifolia is both tonic and astringent, and a decoction of it is a favorite domestic remedy, in the United States, for the cure of diarrhœa.

(1521.) Salicaceæ. The willows (*Salices*), and poplars (*Populi*), form, together, a very extensive type as regards species, although containing two genera only, which are distinguished from each other by the inferior radicle of salix, and the superior radicle of populus, as well as by the gland at the base of the one-celled follicle of salix, while the follicle of populus is almost two-celled, and without a gland. United as a type the *Salicaceæ* are known from the contingent group, especially from *Betulaceæ*, the only one with which it is likely to be con-

founded, by the indefinite erect ovules, those of Betulaceæ being pendulous and definite; as well as by the seeds of the Salicaceæ being crowned with silky tufts, while those of the Betulaceæ are naked.

A. *Salix caprea.* (*a*) Branch with pistilline aments. (*b*) Ditto, with stamineous ones. (*c*) Single stamineous flower, shewing its two naked stamina, arising from the axilla of the bractea or scale, in which there is also seen the abortive pistil. (*d*) The perfect pistilline flower with the abortive stamina. (*e*) Section of the ovary, to shew the many seeds. (*f*) A seed with its down.

B. *Quercus navalis vel pedunculata.*—Branch to shew the peduncled acorns and sessile leaves. (*a*) Pistilline flowers in an early stage. (*b*) Stamineous aments. (*c*) Stamineous flower isolated. (*d*) Pistilline flower isolated, shewing the cupule and rudimentary superior calyx. (*e*) Gland without the cupule. (*f*) Longitudinal division shewing one large cotyledon of the exalbuminous embryo.

C. *Juglans regia.* Branch shewing fruit and pinnate leaves. (*a*) Staminiferous ament. (*b*) Longitudinal section of a pistilline flower. (*c*) Longitudinal section of the ripe fruit, shewing the exocarp, mesocarp, and endocarp, the radicle, plumule, and one of the cotyledons of the exalbuminous embryo. (*d*) Transverse section of the fruit, shewing the two wrinkled cotyledons. (*e*) The seed detached.

(1522.) The *Salicaceæ* are shrubs or trees, often of a large size, with round and scattered branches. The leaves are alternate, simple, and stipulate, the stipulæ being free and caducous, or leaf-like and persistent, [§ 1521, A.]

The foliar margins are serrate or crenate, and the costulæ deliquescent. Foliar glands are often, but not universally present.

The flowers are separated, either monœcious, or more frequently diœcious; and collected into cylindrical or ovate catkins. The stamineous ones consist of stamina, from two to twenty-four in number, free or monadelphous, with erect

two-celled anthers, dehiscing by longitudinal chinks, and arise from a glandular torus situated in the axilla of a squamaceous bracte. The pistilline flowers are achlamydeous, and consist of a fusiform germen with two styles, often connate, and terminated by emarginate or bipartite stigmata. The ovary is superior, one-celled or sub-bilocular, from the margins of the valves becoming introflexed. The trophosperms are two, parietal, and many-ovuled; and the ovules erect.

The fruit is a one or two celled, oblong, coriaceous capsule, two-valved and dehiscing downwards. The seeds are many, and attached to the lower part of the cell, exalbuminous and comose. The embryo is straight, and the radicle inferior.

(1523.) Hence, differentially considered, the *Salicaceæ* are achlamydeous *Quercinæ* with indefinite comose seeds, [§ 1521, A.]

(1524.) The willows are extremely useful plants, and afford, from wet and swampy soil, where few other trees will flourish, oziers for basket-making, bark for tanning, and a peculiar alkaloid named salicine, which appears likely to rival the Quinine of Peruvian bark, in the successful treatment of intermittent fevers.

S. caprea, fragilis, and *alba*, are those chiefly esteemed for their febrifuge properties, but the bark of most of the species is astringent and tonic. Sir Humphry Davy found willow-bark to contain as much tanning principle as that of the oak; the species in which it is most abundant are *S. Russelliana, alba*, and *purpurea*, the latter of which is the toughest of all the willows.

Salix herbacea is the smallest tree existing; it varies from one to three inches in height; its leaves are used in Iceland for tanning leather.

(1525.) The known species of willow amount to nearly 200, the majority of which have been figured by the Duke of Bedford, in his *Salictum Woburnense;* and it is greatly to be deplored that so few copies of that splendid work were printed, and more especially, as of all genera the species of this are perhaps the most difficult of distinction.

(1526.) *S. alba* is the most valuable of the whole as a timber-tree, and, when pollarded, is very productive of poles, fence-wood, crate-ware, and fuel.

S. viminalis, vitellina, and others, are cultivated in swampy districts under the name of osiers, and their use for basket-work, hoops, &c. is well known. They are remarkably quick growing plants, whence indeed their generic name.

(1527.) Willows are much used in the manufacture of charcoal; and it has been proved that willow-charcoal is superior to that of most other wood for the preparation of gunpowder. Before the introduction of coke into our iron-works, such immense quantities of wood were annually converted into charcoal, that Evelyn, in his Sylva, expressed a fear that the demands of the furnaces would lead to the entire destruction of our forests. Indeed, the Forest of Dean was almost wholly consumed in the reduction of the iron ore that abounds in its locality. Even in 1788, twenty-six out of the eighty-six iron furnaces then at work in England, were heated by wood-charcoal; but in 1826, the three hundred and five, to which they had increased, were all fed by pit-coal coke.

(1528.) The weeping willow, (*S. Babylonica*,) which is the most ornamental species, has received its specific name from the supposition that it was upon such trees that the Israelites hanged their harps, when by the waters of Babylon they sat down and wept on the remembrance of Sion. But modern travellers affirm that it is a mountain-plant, and not an aquatic one. Pope's willow, at Twickenham, which was sacrilegiously cut down a few years ago, was the parent of many

of those now growing in this country, as it was a favorite source; it is said to have been raised from a rod that with others formed the outer part of a package arrived from Spain, and which the poet planted, thinking it exhibited some signs of vitality.

Salix Babylonica.

(1529.) Of the poplars the Abele (*P. alba*), and the Aspen (*P. tremula*), with the Lombardy species (*P. fastigiata* or *dilatata*), are the most common here. The first is one of the more valuable, its wood being in much request by turners, and its lightness also recommends it for the construction of portable wooden vessels, such as butchers' trays, troughs, &c. The second affords a very light white timber, now chiefly used by patten-makers.

(1530.) Monkish chroniclers report that the cross was made of aspen wood, and hence they would account for the trembling of the leaves, which they affirm have never rested since the crucifixion.

(1531.) The Lombardy poplar is peculiarly fertile in its growth, but not without beauty; in port it resembles the cypress, and its wood is well fitted for packing-cases and boxes, as nails do not split it. In Lombardy all the vessels in which the grapes are carried home from the vineyards are of poplar plank.

(1532.) The seed-down of the various poplars, as well as that of the willows, is sometimes used for stuffing cushions, either alone or mixed with other materials: from it paper has been also manufactured. In Kamtschatka the inner bark is occasionally made into bread; and in Sweden the leaves and young shoots are gathered as winter fodder for sheep. The buds both of the *P. alba* and *tremula* have a peculiarly pleasant smell in spring, and yield a resinous substance likened to storax; but *P. balsamifera* affords a much more abundant supply, which is collected for medicinal purposes, and is brought into Europe from Canada in shells. It is said to be diuretic and antiscorbutic: the bark of P. tremulöides is also prescribed as a febrifuge in the United States. The bark of *P. tremula* is the favorite food of the beaver; it is likewise used, from its lightness, as net-floats by fishermen instead of corks. Poplar wood does not take fire rapidly, and rarely bursts into flame, it is therefore well fitted for heating ovens, but a bad fuel for common purposes.

(1533.) Betulaceæ. The birch (*Betula*), and the alder (*Alnus*), formerly

considered a species of the former genus, although now generically distinguished, are associated in a common type, the BETULACEÆ.

(1534.) The *Betulaceæ* are either trees or shrubs with exarticulate branches; the leaves are alternate and simple; the costulæ run direct from the midrib to the margin, which is either toothed or serrate; and the stipulæ are caducous. The flowers are monœcious, and the inflorescence in cylindrical or subrotund aments. The stamineous flowers, generally naked, are occasionally surrounded by a three or four lobed calyx, and spring from the axillæ of imbricated bracteæ. The stamina are variable in number, for the most part discrete, rarely monadelphous, and the anthers are two-celled.

The bracteæ of the pistilline aments are generally deciduous, but occasionally persistent, and lignescent; and from the axillæ of each scale spring two or three flowers destitute of perianth, each consisting of a superior two-celled germen, with connate or obsolete styles and elongated filiform stigmata. The ovules are one in each cell, attached to the upper part of the placenta. The fruit is a strobiliform ament, the pericarp dry and indehiscent with membranaceous winged edges, two-celled, or by abortion one-celled and one-seeded. The seeds downless, pendulous, and exalbuminous. The embryo straight, the radicle superior, and the cotyledons epigean, and during germination foliaceous.

(1535.) Hence, differentially considered, the *Betulaceæ* are foliose *Quercinæ*, with a free two-celled germen, definite pendulous ovules, and downless seed-coats.

(1536.) The wood of the alder is valued for works exposed to the action of water, especially such as are constantly submerged. Before the iron manufacture was so much improved, alder was in much request for water-pipes, on account of the ease with which it can be perforated when green: it is also valuable as affording one of the best charcoals, some persons say superior to the willow, for the manufacture of gunpowder; and no other wood forms carbon that answers so well for galvanic experiments, alder-charcoal being always preferred for the points that connect the poles of voltaic batteries and other similar apparatus. The bark is used both by dyers and tanners, the sap being of a yellow colour and very astringent. In decoction it is employed as a gargle in relaxations of the mucous membrane of the fauces; and in double the dose of cinchona it has been administered with success in cases of ague.

(1537.) The birches are not only beautiful trees, but, from growing where other wood is scarce, often valuable as timber, and from intermediately as well as directly affording food to man. Ornithologists affirm that the birches form the principal attraction to the birds which are found in such plenty in high northern latitudes, the catkins yielding them food in the spring, and the seeds during the remainder of the year. The grouse and ptarmigans seem to prefer the *B. nana*, the smaller birds the *B. alba*. Many indeed are the economical purposes to which the various parts of these plants have been applied in countries unblessed with a luxuriant vegetation. In the northern parts of Europe, and even in Scotland, the bark is used to tan leather and to make ropes; and the outer rind, which contains a resinous matter, the Highlanders call Meillag, and once were wont to burn instead of candles. With fragments dexterously braided or interwoven, the Laplanders make shoes and baskets; and large thick pieces, which easily separate from the wood and form hollow cylinders, or those which are flattened out and a hole made at one end for the neck, like a drayman's leathern apron, they are said

to use as surtouts to keep off the rain. The Americans make entire canoes of birch-bark, especially of that of the B. papyracea, which is hence called "canoe birch," and the weight of one of these vessels, large enough to hold four persons, does not exceed fifty pounds. The Russians, Poles, and Swedes, use birch bark likewise to cover their houses instead of tiles. The inner bark was one of the materials on which the ancients wrote before the invention of printing. The wood was formerly used by the highlanders to make their arrows, but it is now converted into ploughs, carts, rakes, and most of the rustic implements of agriculture. The smaller branches are made into hurdles, broom-handles, &c. and the pliant twigs into rods and besoms. By the turner the wood is esteemed for making trenchers, bowls, spoons, ladles, &c. and the knobby excrescences afford a beautifully veined wood. It is also prized as fuel, forms good charcoal, and yields an excellent lamp-black for making printers' ink.

The black birch of America (*B. lenta*), called also mountain mahogany, from the beauty of its wood, affords one of the hardest timbers of the whole genus, and is perhaps the most valuable.

(1538.) A pyrogenous oil is procured from the bark of the white birch by distillation, which has a very peculiar odour; it is with this oil that skins are dressed in Russia, and to it the Russia leather owes its fragrance. It is said to be inimical to insects, and hence such leather is in great request for bookbinding: many attempts have been made to prepare a similar article in this country and in France, but they have all been hitherto unsuccessful.

(1539.) The sap of the birch is convertible into wine, vinegar, and spirit, and from it sugar may be obtained. From a large tree tapped in the spring several gallons of saccharine sap may be drawn daily without obvious injury to the plant, which forms when fresh an agreeable beverage, and when fermented an intoxicating liquor.

The weeping birch (*B. pendula*), is one of the most graceful of alpine plants, and when of a large size, its pendant branches, not thicker than common packthread, are often thirty or forty feet in length. Coleridge, in the true spirit of poetry, has called it the "Lady of the Woods."

(1540.) The *Betulaceæ*, *Salicaceæ*, *Myricaceæ*, and *Casuarinaceæ*, though differing in the several particulars described, all agree in having the germen free and superior, which circumstance contrasts them with the two remaining types, *Corylaceæ* and *Juglandaceæ*, included in this section, in which the germen is inferior, and the tube of the calyx adnate. Hence two subsections are distinguishable, the *Betulianæ* and the *Corylianæ*, in the first of which not only is the germen free, but the flowers, both the stamineous and the pistilline ones, are disposed in aments; while it will be found that in the second, besides the adherent calyx, which is the essential sign, the stamineous flowers alone are disposed in aments, the pistilline ones being subsolitary, and the bracteæ, in general, collected into whorls, called *involucra*, thus often forming a cup-shaped organ, or *cupule*, as in the acorn; whence indeed one type has been by some botanists named the *Cupuliferæ*.

(1541.) Corylaceæ. The oak, the hazel, the hornbeam, the chesnut, and the beech, which are associated to form this type, are trees or shrubs with much-branched stems, round and exarticulate; their leaves are alternate, simple, and

stipulate, with costo-marginal costulæ, and serrate or pinnati-lobed, rarely entire edges; the stipulæ are free and caducous.

The flowers are monœcious, the stamineous ones collected into cylindrical or rarely roundish scaly catkins; the stamina variable in number (from four to twenty-four), arising from the scaly bracteæ, or from a squamaceous (four to six cleft) calyx. Filaments mostly free, rarely connate, anthers erect and two-celled; the connectivum continuous with the filament, and sometimes prolonged into a beard.

The pistilline flowers are either arranged in aments, or contained within an involucre that becomes coriaceous or woody, and surrounds or includes the fruit. The perianth is adherent to the germen, the limb being obsolete or very minute. The inferior germen is two to six celled, the ovules one to two in each cell and pendulous, the styles two to six, often connate, the stigmata free.

The fruit is a gland or nut, by abortion one-celled, and often only one-seeded. The seed pendulous and exalbuminous; the embryo large, the small radicle superior, and the cotyledons plano-convex, fleshy, or foliaceous; hypogean in the first case, and epigean in the second, [§ 1521, B.]

(1542.) Hence, differentially considered, the *Corylaceæ* are cupuliferous *Quercinæ*, with subamentaceous flowers, inferior ovaries, pendulous seeds, and smooth cotyledons.

(1543.) Few trees have been more highly and more constantly valued than the oak, and still fewer have been esteemed in different ages from such different causes; for seldom as acorns are eaten now, and much as oaken timber is at present worth, it was formerly for the fruit alone that the tree was prized. At one time, in most countries, when the mind was as uncultured as the soil, the rude unsettled tribes sought from the trees of the forest their chief supplies of vegetable food. Not that the oak was the exclusive source, but as being the principal of the gland-bearing trees, its name was given to several of the others, such as the chesnut and the beech; and the term gland, like βαλανος or γαλανος, seems also to have been extended to eatable fruits in general: thus the date was called *glans Phœnicia*, the chesnut *glans Sardinia*, beech-mast *glans fagi*, and the walnut *glans Jovis* or *juglans:* just as with us *acorn* is but an abbreviated form of *aac*, or *oak-corn; corn* and *kernel* being common names for seeds, and the former having become the collective denomination of the cereal grains, by which the use of most others has been superseded.

(1544.) The food of the *Balanophagi*, it will hence be evident, was not so despicable as it has been sometimes thought to have been, and, besides the inclusion of various fruits under the common name of glands, the acorns of many of the levantine and other exotic oaks, such as the *Q. Ballota*, *Q. Ilex*, and especially the *Q. Esculus*, bear fruit which is even now esteemed and eaten in Spain, and Barbary, as chesnuts are in the more northern parts of Europe.

In Britain, although it is unknown that acorns ever formed the common food of the inhabitants, it was for them alone that the oak was prized, as furnishing the chief support of the large herds of swine on which our forefathers fed. Woods, of old, were valued according to the number of hogs they could fatten, and so rigidly were the forest-lands surveyed, that in ancient-records, such as the Doomesday book, woods are mentioned of "a single hog." The right of feeding swine in the woods, called *Pannage*, formed, some few centuries ago, one of the

most valuable kinds of property. With this right monasteries were endowed, and it often constituted the dowry of the daughters of the Saxon kings. Indeed, the encroachments of the Norman princes on this common right, in their passion for preserving forests for the chase, was one of the more grievous wrongs of which the oppressed people in those times complained, and relief from which was wrung from John, amongst other privileges, on the plains of Runnymede.

(1545.) The history of the oak, whether natural or traditional, is one replete with interest. The reverence in which the tree was held, the oracles sought from it of old, the druidic priesthood, and the superstitions connected with it in other ages, all combine to render the annals of the oak, the chronicles of this forest-king, in great part a history of the human race. Here, however, the introduction of such memorials would be out of place, and the curious in these matters are referred to my *Amœnitates Querneæ,* in which the most important particulars will be found condensed.

(1546.) Upwards of a hundred species of oak are enumerated in Sprengel's catalogue, the majority of which are natives of the New World. The most important of these many species are the *Q. navalis* (pedunculata vel Robur), or ship oak, and the *Q. virens,* for timber; the *Q. Suber* or cork-oak, for its useful bark, *Q. infectoria* for its galls, and the *Q. ægilops, coccifera,* and *tinctoria,* which yield the Velani acorns, the *Kermes,* and the Quercitron bark.

(1547.) The British naval oak, our great father of ships, the timber of which is unrivalled for its strength and durability, has been frequently confounded with one or two other species, also growing in this country, the wood of which is far less valuable and enduring, and to their substitution for the true naval oak, the destructibility of many modern-built vessels has been, with justice, in great part attributed.

(1548.) The oak which yields the inferior timber is said to have been introduced into this island from the continent, and from the freedom of its growth, and the abundance of fruit it bears, to have established itself firmly in various parts of the country: it has even been encouraged unwittingly in plantations, through the ignorance of those entrusted with their care, although the error has been frequently pointed out by botanists. The true naval oak is easily distinguishable from the others growing wild in Britain, by the acorns being seated on long stalks, and the leaves subsessile or without any, [§ 1521, B. a.]; while the inferior oak has sessile acorns and leaves with lengthened footstalks.

(1549.) Much indeterminateness exists in the nomenclature of these several oaks; for, although distinguished by Ray, they were all included by Linneus in his single species Robur, and since again separated, the classic adjunct has been given to each of the three species by different botanists. Smith calls the peduncled oak *Q. Robur,* and thinks that Willdenow was countenanced in a wilful error by the Hortus Kewensis, in giving that title to the sessile fruited one; whereas, from the description of Pliny, and the older writers, it would seem to belong most correctly to the downy-leaved or Durmast species, the chêne noir of the French: for the wood of this oak is of a dark colour, as described by Festus Pompeius. It agrees also with the account of Pliny, who calls it 'Robur exalburnatum,' and says 'Robur marina aqua corrumpitur,' neither of which descriptions will accord with our naval species. I have hence elsewhere proposed to avoid this perplexity by calling the naval oak *Q. navalis,* the sessile-fruited

species *Q. regalis,* and the Durmast oak *Q. Robur.* (See Amœnitates Querneæ p. 3.)

(1550.) The timber of the naval oak, which is to us invaluable, was required during the late war in such immense quantities to meet the urgent demands of our dock-yards, that the British forests were thinned of their larger trees, and serious apprehensions once entertained that our native sources of supply would be exhausted. Indeed, it is a well known fact, that long before the peace a scarcity was felt, especially of the larger kind of timber fit for ships of the line; and so great was this want, that it has been stated on good authority, if Sir Robert Seppings had not contrived the means of substituting straight timber for that of different forms and dimensions, before considered indispensable, the building of new ships must entirely have ceased.

This scarcity excited the attention of the government and the public; and, since then, many patriotic persons have made large plantations of oak, and parts of the royal forests have been dedicated to the growth of this valuable tree; so that, in future, notwithstanding the large quantities required, the supply will in all probability be equal to the demand. Of the extent of this demand some general notion may be obtained from the report of the Commissioners of land revenue, printed in 1812. It is there stated that, taking the tonnage of the navy in 1806 at 776,087 tons, it would require, at $1\frac{1}{2}$ load to a ton, 1,164,085 loads to build such a navy; and, supposing the average duration of a ship be fourteen years, the annual quantity of timber required would be 83,149 loads, exclusive of repairs, which may be calculated to take 27,000 loads, making the whole about 110,000 loads.

Now it is estimated that not more than forty oak trees can stand on an acre of ground so as to grow to a full size fit for ships of the line, or to contain each $1\frac{1}{2}$ load of timber: and it is known that each seventy-four gun ship consumes, in building, 2000 tons or 3000 loads, so that 2000 oak trees, the full produce of fifty acres, are required to construct one such vessel. But as 110,000 loads are annually wanted, and as an oak tree is at least 100 years in arriving at a fit state to be cut for ship timber, nearly 200,000 acres of land would be required for the growth of oak alone to keep up a successive supply for maintaining a navy of about 800,000 tons, were not timber procured during war from prizes, and other incidental sources. The supplies thus gained were, during the last war, very considerable, and our enemies were by no means unconscious of their extent; for, with their characteristic levity, which is proof against misfortune, they absolutely called the superintendant at Breschai, in the time of Napoleon, '*Purveyor of arms to the British navy,*' as he himself informed my friend, Mr. Bond, soon after the peace; for, added he, no sooner were our ships fitted-out from the port of Venice, than they fell into your hands.

The above calculations are however but partial, as they refer to the royal navy alone; and hence to the account there must be added that in the service of the East India Company, and the 20,000 merchant-vessels of a mean burden of 120 tons, which, according to Moreau's tables, is the average number at any one time employed in the commercial navigation of England and Scotland, besides our vast home demands, for the construction of docks, wharfs, canals, flood-gates, &c. which exceed in amount those of the Royal navy.

(1551.) The value of oak bark is only inferior to that of its wood. From the

tanning principle which in it is so abundant, it is the bark chiefly employed by tanners in the making of leather, one of the most important manufactures of this country, ranking either the third or fourth on the list, and surpassed only by those of cotton, wool, and perhaps of iron, the value of articles annually manufactured from leather being estimated at from 12 to 16,000,000*l*. Besides the oak-bark afforded by our own plantations large quantities are imported, chiefly from Holland and Belgium, averaging about 40,000 tons per annum.

(1552.) The astringency of oak-bark has recommended its employment medicinally in sanguineous and other fluxes; it has also been used both alone, and combined with other bitters and aromatic drugs, as a febrifuge; and, according to Merat and Lens, it entered largely into the preparation of the factitious cinchonas, which the French physicians were compelled to substitute for Peruvian bark during the war, when the whole European continent was blockaded by the British navy.

The leaves of the oak are astringent, but much less so than the bark; they have hence been occasionally used in the tanning of leather, and also officinally as styptics: the leaves of *Q. falcata* have on this account been especially recommended as an external application in gangrene.

(1553.) The oak is peculiarly subject to the attacks of insects, which cause the production of many varieties of galls; some particular kind being found on almost every part, such as the roots, branches, buds, leaf-stalks, flower-stalks, and even on either side of the leaves. Of these adventitious productions, once mistaken for the fruit of the tree, the most important is that known in commerce as the gall-nut, and which is brought to this country from the Levant, chiefly from Aleppo. The oak on which the nut-galls are found is a small shrubby species called *Q. infectoria*, that is common in all parts of Asia Minor, especially in the neighbourhood of Smyrna and Aleppo. The galls, which are the result of the puncture of a small insect named *Diplolepis gallæ tinctoriæ*, (vide Med. Bot., clii.), are the only valuable produce of the plant, and they form a very important article of commerce. Oak-galls are among the most powerful vegetable astringents known, and hence they form the basis of most styptics, and enter into the composition of many astringent medicines. An infusion of galls is the best antidote for an overdose of ipecacuanha, rendering it almost immediately inert.

Galls contain, besides tannin, mucilage, and extractive matter, a peculiar principle called gallic acid, which strikes a deep black colour with the soluble salts of iron. This property renders them valuable as a dye-stuff; and hence indeed, from their great request by dyers, the oak which bears them has been named *Q. infectoria*. They also form the basis of modern writing-ink.

(1554.) The once well-known dye called Kermes, now in great measure superseded by the West Indian cochineal, is a species of coccus, an insect that infests the Q. coccifera, as another does the Cactus coccinellifer. This oak, which is common in the Levant, is valued, like the preceding, only for its adventitious produce; and, before the introduction of cochineal, the Kermes was the base of most of our crimson dyes: it is still used by the Greeks and Turks to dye the scarlet caps so commonly worn in Eastern countries.

(1555.) Quercitron is the bark of the Q. tinctoria; in America it is used to tan leather, but here only to dye yellow: the acorn-cups of the Velani oak, Q.

Ægilops, are also imported as a dye-stuff, and are used sometimes, instead of gall-nuts, to strike a good black with iron, as well as in the process of tanning.

(1556.) Cork is the bark of *Q. Suber*. This oak is a native of the northern parts of Africa and the southern ones of Europe. The trees yield octennial or decennial crops, from the age of about fifteen years to that of a hundred and fifty, and are said to be more vigorous, healthy, and long-lived when the cork is periodically removed, than when it is left to accumulate on their trunks. The uses of cork are too well known to require enumeration; but, besides the purposes to which in this country it is commonly applied, in Spain and Portugal layers of it are used to line the rooms, and laid down instead of carpets in the brick-floored chambers.

The European markets are chiefly supplied from the Peninsula, the French cork being inferior to that of Spain and Portugal. About 2500 tons of cork are annually imported into Britain from the two last named states. The soot collected from burnt cork forms Spanish black.

(1557.) *Q. virens*, or the live oak, is the most valuable for its timber of all the American species; and, besides this, and the foregoing, many others either have been or might be applied to various economical purposes; the above, however, are sufficient illustrations of the importance of the genus.

(1558.) While some of the oaks are dwarfish shrubs, others attain an immense magnitude, and live through uncounted years. Few trees indeed are known to exceed them either in bulk or age, [§ 97.] Of their size some instances have been already given, and others might easily be added; for there are many venerable oaks in this country which, as Gilpin says, 'chronicle on their furrowed trunks ages before the Conquest;' and some, such as the Salcey and the Cowthorpe, that perhaps may antedate the Christian era.

(1559.) The chesnut and the beech, associated by Linneus as species of the same genus, have by modern botanists been distinguished into two, named *Castanea* and *Fagus*. It is probable that the φηγος of the Greeks was not the Fagus of the Latins, but either the chesnut or *Q. Æsculus*, as the name has evident reference to the fruit being used as food; and beech-mast would form a far inferior diet to chesnuts. The beech is chiefly valued for its wood, but it is not considered by foresters in general as a timber tree; for it is neither strong nor durable: it is chiefly employed, from the closeness of its grain, for tool-handles and in machinery. Beech-nuts abound in oil, and a patent some years ago was taken out for its extraction, but it was found more profitable to fatten swine upon them than to sell them to the patentee.

(1560.) The chesnut is much more valuable than the beech, both for its timber and its fruit; it is also a more handsome and noble growing tree. Some instances are given in which the chesnut is said to have arrived at a most extraordinary size and age, such as the *Castagno de cento cavalli*, which, according to Brydone, measured 160, some say 204, feet round the remains of its hollow and dissevered trunk, [§ 103.]

Chesnuts are much less eaten in England than on the continent; there they are not only roasted, but boiled, and also ground into meal, and made into cakes, bread, and puddings.

(1561.) The genera, *Corylus*, *Carpinus*, and *Ostrya*, are of less import-

ance than the preceding; the first includes the several species of hazel-nut and filbert—the 'nuces Ponticæ' of the Romans, so called from their being brought to Italy from Pontus, a name which has been subsequently changed to *avellanæ*, from their growing most abundantly in a valley near the town Avellino, in the kingdom of Naples, whence they are exported in large quantities. Swinburne says, in his time, the growers in that district cleared an annual profit of 12,000*l*. by the sale of nuts alone.

(1562.) *Carpinus Betula* is much used in the construction of rustic implements of husbandry, especially yokes for cattle, whence its name, hornbeam; its catkins are said to be sometimes fraudulently mixed with hops.

The *Ostrya* or hop-hornbeam, still more closely resembles the true hop: the wood of the American species (*O. virginica*) is very hard and heavy, which may account for its being commonly called iron-wood or lever-wood.

(1563.) Juglandaceæ. The hickory (*Carya*), and the wall-nut (*Juglans*), have been separated by De Candolle from the *Terebinthacæ*, a group to which they have several strong affinities, and formed into a type called (*Juglandeæ*, or rather) Juglandaceæ. These plants, by their spicate or subamentaceous apetalous staminiferous flowers, inferior one-celled ovarium, exalbuminous embryo, with large wrinkled or sinous cotyledons, evidently shew an affinity to the *Corylaceæ;* and by the occasional development of four petals in the pistilliferous flowers and the nut becoming drupaceous, declare as strongly that the group is transitional from the monochlamydeous to the dichlamydeous districts: of which a still more beautiful example will be found in two small orders which pass from the Ulmaceæ onwards.

(1564.) The Juglandaceæ [§ 1521, c,] are ramose arboreous plants, with alternate impari-pinnate undotted leaves destitute of stipulæ.

Their flowers are monœcious, the stamineous ones collected into aments, the pistillines subsolitary, or two or three growing together on short terminal foot-stalks.

The stamineous flowers are each attached to a single bracte, the calyx subpedicellate, oblique, irregularly 2-6 partite, and herbaceous. Petals none. Stamina three to thirty-six, hypogynous. Filaments free and very short; anthers erect and two-celled, with a longitudinal dehiscence, and the connectivum continuous with the filament.

The pistilline flowers are destitute of cupules, the ovarium is inferior, the tube of the calyx being adnate with the germen, the limb four-cleft and deciduous. Petals usually absent, occasionally developed, four in number and marcescent. The germen is one-celled, formed of two confluent carpella, and one-ovuled, the ovule being erect. The styles one or two, very short or none. Stigmata cleft, dilated, and either discoid, four-lobed, or fringed.

The fruit is drupaceous, subglobose, or subovate. The mesocarp coriaceous and seceding from the endocarp, which is woody, two-valved, often rugose, one-celled with four incomplete dissepiments, and one-seeded. The seed is erect, inferiorly four-lobed, exalbuminous, and covered with a membranaceous testa and very distinct delicate tegmen. The embryo is large, with two large wrinkled, oily, and fleshy cotyledons, the radicle short and superior, and the plumula with two pinnate leaves.

(1565.) Besides their amentiform inflorescence, apetalous flowers, and exalbuminous seeds, by which they are associated with the Quercinæ, the *Ju-*

glandaceæ are distinguished from all other groups by their definite erect ovules, wrinkled cotyledons, and unequally pinnated leaves destitute of dots and stipulæ.

(1566.) The *Juglandaceæ* are much esteemed both for their timber and their fruit. Before the introduction of mahogany and other modern fancy woods, the walnut was much prized, and greatly employed in the construction of ornamental furniture: its chief use now is for gun-stocks; and, during the late war, so much was required for the supply of our troops, that walnut-trees of a size fit for timber fetched a very high price, and surveyors were employed to seek them throughout the country.

The fleshy cotyledons of the nuts abound in oil, which is in some places expressed. It is one of the oils which do not congeal by cold, and which, drying on exposure to air, are valuable in the art of painting. It is also used instead of olive and almond oils in cookery. The *mark* or *nut-bread*, as it is called, which is left after the expressure of the oil, is very nutritious, and is used to fatten poultry and other domestic animals. It has been stated, on the authority of Tournefort, that walnut oil taken in large quantities produces intoxication; but this statement requires confirmation.

Walnut oil is peculiarly prone to become rancid, and then it is indigestible, whether in its separate form or in the nut. Otherwise, walnuts are not so unwholesome as they are generally esteemed.

The sap of the walnut tree, if withdrawn during the spring, abounds in saccharine matter, which on evaporation affords sugar equal to that from the beet-root, and it is said will crystallize as well as that from the cane; when fermented, it affords an intoxicating liquor or walnut wine.

(1567.) An opinion has long prevailed that the exhalations of the common walnut tree are deleterious, producing stupor, and even fever, in those who sit under its shade. These accounts are doubtless exaggerated, but it is well known that the strong odour of the leaves will bring on headach in many persons.

(1568.) The bark, as well as the leaves of the several species, is extremely bitter and astringent; it has been recommended as a febrifuge, tonic, and stomachic, and also as an anthelmintic. The inner bark of the root of Juglans cinerea, *L.* (*J. cathartica, Mich.*), is purgative in doses of gr. x.—℈i. and it is said to be peculiarly mild in its operation. The odour of this species is the most offensive of the whole, and hence it has been administered in extract as an antispasmodic. The leaves contain so much acrid matter, that when powdered they are used in the United States as a substitute for cantharides. This species yields much oil, and hence is commonly known as the "butter-nut or oil-nut." A kind of bread is made from the kernels of *J. nigra*, and in their natural state the nuts are a favorite food both with brute animals and men.

(1569.) The different species of hickory (*Carya*), yield nuts less grateful than the true walnuts, but still wholesome and nutritious. The best are those of the *C. olivæformis* and *sulcata;* the first-named is the Pekan nut, and its flavour is delicious. The bark of *C. alba* is acrid, and used as a caustic; its wood is of a light colour, and valuable for its elasticity and toughness.

ULMINÆ.

(1570.) The *Elms* and their allies, sometimes associated with the *Quercinæ*, and sometimes with the *Urticinæ*, to both of which

they are related, although they differ from both, are perhaps most naturally disposed when they are formed into an intermediate section, that connects not only the two abovenamed with each

B. *Ulmus campestris.* Branch with leaves and fruit.

(*a*) United subamentaceous flowers.

(*b*) One flower separated and magnified, to shew the calyx, bractea, five stamens, and two pistils.

(*c*) Pistil separated.

(*d*) Embryo, with one cotyledon removed.

other, but both with the *Laurinæ*, and also with the following order, as will be seen by the abortive stamens in two of the types forming corolline scales, or even in one instance becoming petaloid.

(1571.) Three types are referred to this section, which, from their respective normal genera, have been named respectively ULMACEÆ, CHAILLETIACEÆ, and AQUILARIACEÆ. The first however alone indisputably belongs to the section, the latter exhibits an equal affinity with the *Thymelæaceæ*, of the *Laurinæ;* but the *Chailletiaceæ*, as an intermediate group, determines their location here.

(1572.) The Ulminæ, collectively considered, are exalbuminous Querneales, with united flowers, subamentiform inflorescence, and alternate leaves.

(1573.) ULMACEÆ. The *Ulmaceæ* are trees or shrubby plants with exarticulate branches, alternate, simple, petiolate, scabrous, serrate leaves, the stipules being free and often caducous.

The flowers are united, or by abortion polygamous, and collected into subamentiform clusters. The calyx is free, campanulate, and cleft at the edge, with

an imbricate æstivation. The stamens are definite (five,) and all fertile, exserted from the base of the calyx, and erect in æstivation. The anthers are free, two-celled. The ovary free and two-celled, the ovules solitary and pendulous, and the stigmata two and distinct.

The fruit is one or two-celled, membranous or drupaceous. The seed solitary, pendulous, and without albumen. The embryo inverted; the cotyledons entire and foliaceous; the radicle short and cylindrical, and the plumula small.

(1574.) Hence, differentially considered, the *Ulmaceæ* are subamentaceous Querneales with definite exalbuminous, pendulous seeds, stamens few and fertile, cotyledons foliaceous, and leaves scabrous and serrate.

(1575.) The elms are for the most part large handsome trees, but their timber is of far less value than either oak, chesnut, or pine. It is coarse-grained, and although strong and tough, it is liable to warp and shrink in dry situations, and hence is unfit for building. When wholly under water it is durable, but between wind and water it soon perishes. It is therefore generally devoted to the more common and least important works, and its chief consumption in this country is in the construction of coffins, thus saving more valuable wood.

(1576.) Elm-leaves and elm-bark have an astringent and mucilaginous taste: they contain extractive matter, gallic acid, and supertartrate of potash. From the liber, Klaproth obtained a peculiar proximate principle, which he called *Ulmine*. It is tasteless, and sparingly soluble both in alcohol and water: it has not hitherto been applied to any useful purpose. The decoction of elm-bark has gained some reputation in the cure of cutaneous diseases, especially of the herpetic kind; it is administered internally, and also used as a lotion. Dr. Lettsom reports a case of icthyosis cured by its means; but icthyosis is a disease that is seldom submitted in this country to medical treatment, as the 'scaly women' and 'fish-skin' men earn a livelihood by exhibiting themselves at fairs and wakes, and such a disease is by them considered a personal estate of the value of from two to three hundred pounds per annum, which they would be very unwilling to part with, and are only too happy when they can entail it on their children. One of the persons now exhibiting himself is an instance of its being hereditary to the fourth generation.

(1577.) The inner bark of the elm, like that of many other trees, has been, in times of scarcity, and still is commonly, in the northern parts of Europe, ground into powder and mixed with meal to make a coarse kind of bread. Elm-leaves form a good nourishing fodder, and in many parts of this island they are given to cattle. They formed a large proportion of the 'British herb,' of which five-and-forty hogsheads were lately condemned and burnt as imitation tea. Some few species of elm, such as the *U. suberosa* and *Hollandica*, have a spongy development of cortical parenchyma, like the Q. Suber, but it is not sufficient either in quantity or quality to be used economically as cork.

(1578.) Chailletiaceæ. This small group, arranged as a subdivision of the *Ulmaceæ*, by Bartling, appears to be too distinct not to be admitted as an independent type; although the plants included have many points of agreement with the elms. They are small trees or shrubs, with alternate, simple, stipulate leaves, the foliar margins being entire.

The flowers are united, small, and axillary, and the peduncles often connate with the petioles. The calyx is free, the sepals five with an imbricate æstivation.

The corolla is foreshadowed by 5 of the stamina being barren, with petaloid filaments, alternate with which are 5 fertile stamens. The anthers are free, ovate, 2-celled and versatile, and opposite the petaloid filaments there are usually 5 hypogynous glands. The ovarium is superior, 2-3-celled, and the ovules 2 and pendulous; the styles simple, and the stigmata obscurely capitate. The pericarp is drupaceous, with a dry coriaceous rind, 1-2-3-celled, seeds solitary, pendulous, and exalbuminous. The embryo inverted, with a short thick superior radicle, and thick fleshy cotyledons.

(1579.) Hence the chief differential characters of the *Chailletiaceæ* are their united monochlamydeous flowers, petaloid filaments, superior germen, concrete carpella, and solitary exalbuminous seeds, with fleshy cotyledons.

(1580.) But little is known of the properties of these plants: according to Don the fruit of *C. toxicaria* is poisonous, and used in Sierra Leone to destroy rats. *C. erecta* is said to be deleterious also.

(1581.) Aquilariaceæ. *Aquilaria*, the eagle wood, *Ophispermum*, the snake seed, and *Gyrinops*, a genus but little known, are associated to form this type. They are large much-branched trees, with alternate, simple, entire leaves, without dots or stipules. The flowers are united, the calyx free, coriaceous and turbinate, with a spreading 5-lobed border, the stamina are 10, fertile, with short filaments springing from a torus, and alternating with 10 scale-like abortive filaments. The anthers are long and versatile. The germen is stipulate and ovate, and the stigmata short and simple, and the ovules two. The fruit is a pyriform capsule, 2-valved, 2-celled, with a dissepiment in the middle of each valve; the seeds are solitary by abortion, erect, and furnished with an arillus or other appendage.

(1582.) Hence, differentially considered, the *Aquilariaceæ* are monochlamydeous Querneales, with definite erect seeds, the stamens alternating with petaloid scales, and twice the number of the lobes of the calyx.

(1583.) The *Aquilariæ*, especially the species *Agallocha* and *secundaria*, afford that fragrant substance so much esteemed by Eastern nations, and known under the name of *Lign-aloe* or *aloe-wood*. The wood of the plant is (says Don) in its natural state white and inodorous; that possessing the peculiar aroma for which it is valued is supposed to be in a diseased state, as the centre layers become of a darker hue, and saturated with a resinous matter, which, when the tree dies, is taken out and called Agallochum. This drug is sometimes sold for its weight in gold, and is burnt as incense on high festivals in the East. It has also been recommended, but on a doubtful authority, as a good medicine in cases of palsy, and as useful in vertigo, as well as in alvine fluxes and rheumatism.

URTICINÆ.

(1584.) This section includes five types, which, from *Monimia*, *Datisca*, *Urtica*, *Platanus*, and *Stilago*, the respective normal genera of each, are called the *Monimiaceæ*, *Datiscaceæ*, *Urticaceæ*, *Platanaceæ*, and *Stilaginaceæ;* and as the whole agree with the nettle (*Urtica*) in certain general characters, they are collectively denominated Urticinæ.

(1585.) The *Urticinæ* (or nettles and their allies), are amentaceous or subamentiform Querneales, with separated (rarely united) flowers, superior ovaries, and albuminous seeds, (the albumen sometimes abortive.)

(1586.) STILAGINACEÆ. *Antidesma*, and the species separated from the old genus under the name of Stilago, are still associated to form a small natural group called by Agardh, *Stilagineæ*, but which the scheme of nomenclature here proposed will slightly vary as above.

(1587.) The *Stilaginaceæ* are East Indian trees or shrubs, with alternate, simple, stipulate leaves, the stipules being deciduous.

The flowers are for the most part separated and collected into amentiform spikes or racemes. The calyx is 3-5 parted; corolla absent, stamens 2-5 exserted from an enlarged receptacle, with capillary filaments and innate 2-lobed anthers, with vertical cells dehiscing transversely. The germen is superior and 2-ovuled, the style absent, and the sessile stigma 3-4-toothed. The fruit is drupaceous, and by abortion 1-seeded. The seed is pendulous with a large fleshy albumen, in the midst of which is contained a green embryo with foliaceous cotyledons.

(1588.) Hence the chief differential characters of the *Stilaginaceæ* are their having apetalous subamentiform flowers, 2-lobed anthers dehiscing transversely, collateral pendulous ovules, solitary superior ovaries, seeds solitary, albumen large, and embryo green, with leaf-like cotyledons.

(1589.) The bark of several species of *Antidesma* is used in the East Indies in the manufacture of ropes; whence indeed, according to some, the name of the genus has been derived. Burman, however, with whom it originated, is said to have meant to indicate by the term the value of the *A. alexiterium* as an antidote; a decoction of its leaves being reputed a specific against the bites of venomous reptiles.

The drupaceous fruits of these plants have a pleasant subacid flavour, some of them resembling barberries, and others dried raisins. Those of the stilagines are also eaten by the native Indians, but are not esteemed by Europeans. The bark of *A. alexiterium* is said by M. Descourtilz to be astringent, and he recommends it as a useful medicine in dysentery.

(1590.) PLATANACEÆ. The *Plane*, the *Bread-fruit*, and the *Cow-tree*; the *Fig*, the Bohun *Upas*, and the *Mulberry*, with the other genera associated to form this type, differ more in their properties and qualities than is usual in natural groups of similar extent; and hence their alliance has been occasionally impugned. The duty of the botanist, however, in developing the natural system, is not to associate only those plants which have properties similar to each other, although such an arrangement in a medical or economic point of view is undoubtedly important, but to marshal them according to their structural affinities, and then to examine and describe their general properties; from which examinations, when collated, it will result that many groups which are homomorphous are homogeneous likewise, while others, although allied by structure, differ greatly in their sensible properties and powers.

(1591.) The *Platanaceæ* are trees or shrubs (rarely herbs), and for the most part lactescent. Their leaves are alternate, rarely opposite, petiolate, simple,

entire or palmatilobed, and either smooth or scabrous, with free caducous stipules.

The flowers are separated, monœcious or diœcious, and collected into subamentaceous heads, or seated on a fleshy receptacle. In the stamineous flowers the perianth is single, either entire or cleft, and membranaceous or herbaceous, the lobes being imbricate in æstivation. The stamina are definite (1-5), opposite the lobes of the calyx, free, and sometimes irritable. The anthers are 2-celled, dehiscing by a longitudinal cleft, having the connectivum continuous with the filament. In the pistilline flowers the calyx is either absent, or like that of the stamineous ones, and persistent. The germen is free, or rarely adnate, and one-celled, and with one (seldom two) pendent ovules. The style single, or when double connate, sometimes lateral, and the stigmata often long.

The fruit consists of utricles or nuts, one or many, seated upon or enclosed within an enlarged, and often fleshy receptacle, and invested by persistent succulent calyces. The seed is solitary (rarely geminate), and pendulous, the albumen fleshy (rarely abortive), and the embryo for the most part curved, with linear cotyledons, and the radicle remote from the hilum.

(1592.) Hence, differentially considered, the *Platanaceæ* are subamentaceous *Urticinæ*, with imbedded or included ovaries, pendulous ovules; the embryo for the most part curved, and alternate stipulate leaves.

(1593.) The genera here associated are distributable into three subtypes, which, from *Platanus* (the plane), *Artocarpus* (the bread-fruit), and *Antiaris* (the upas), are called the *Platanidæ*, *Artocarpidæ*, and *Antiaridæ*.

(1594.) The *Platanidæ* are non-lactescent and achlamydeous, with monandrous congested flowers.

(1595.) The *Artocarpidæ* are lactescent and monochlamydeous, with a congested inflorescence.

(1596.) The *Antiaridæ* are lactescent and monochlamydeous, with solitary flowers, and solitary invested nuts.

(1597.) Platanidæ. The planes, so much prized by the ancients for their ample shade, and hence named, from πλατυς, wide or broad, in allusion either to their graceful expanse of boughs or width of leaves, are very large and handsome trees, the culture of which has been much encouraged in almost every age; they are some of the few that bear the confined atmosphere of London, surcharged with smoke, tolerably well, and hence their prevalence in the squares and suburban gardens.

The planes are physiologically interesting from two circumstances. In the first place there are no trees that have more necessarily deciduous leaves; for the leaf-buds are not as usual developed in the axillæ of the leaves, but are absolutely enclosed within the leaf-stalk, and like the second row of teeth which, in certain animals, when they are developed, push the others out: so, whenever the buds enlarge, the leaves within whose stalks they are enclosed are raised from their articulations, and necessarily perish. And, secondly, there are no trees that so clearly exhibit the results of the annual deposition of new wood, or albumen, and liber, exterior to the old wood of the preceding year, and interior to the last year's bark; for the old layers of the bark forming the volumen, not being very distensible, crack on the enlargement of the woody column within; and the layers not having, as in the oaks, elms, and chesnuts, any very strong attachment to each

other, the exterior coating, when stretched to the uttermost, which it very soon becomes, peels off in large mis-shapen scales, as is seen to occur regularly every autumn.

(1598.) The planes are natives of the warmer parts of the temperate regions both of the Old and New Worlds, but they thrive well in much more northern latitudes. They were naturalised in Italy about the time of the taking of Rome by the Gauls, and have been favorite trees in public plantations ever since. The preference given to them was not however attributable only to their beauty, for an opinion formerly prevailed that these trees were preservatives against pestilential diseases. Chardin assures us that the plague had to his time never recurred at Ispahan since plantations of planes were made in the neighbourhood of the city.

The planes afford valuable timber, and grow to a great size. Several of enormous bulk are mentioned by historians, such as the plane of Caligula, within which he used to dine, with many of his train; and the Lycian plane, which is said to have been eighty-one feet in circumference. The celebrated Scotch snuff-boxes are made of plane wood, and it is calculated that a piece of timber, costing the artisans 25 shillings, will make 3000*l.* worth.

The bark of the planes is slightly astringent, and the leaves have been used in fomentations. Once they were considered an antidote to serpent-bites.

(1599.) *Artocarpidæ.* The bread-fruit and the jaca (*Artocarpus incisa* and *integrifolia*), the figs (*Ficus*), in all their numerous varieties; the celebrated cow-tree (*Palo de Vacca*), of South America; the contrayervas (*Dorstenia*), the mulberry (*Morus*), and the paper-mulberry (*Broussonetia* or *Papiria*), form, with other contingent genera, a large, important, and very diversified subtype, in which are found some of the most mild and harmless, and some of the most poisonous vegetables known.

(1600.) The flowers here, as in the Platanidæ, are monœcious, and in some amentaceous; the aments however become in many enlarged and often succulent receptacles, on which the flowers are seated, or within which they are enclosed. Of these gradations, *Artocarpus*, *Dorstenia*, and *Ficus*, afford excellent examples; the fruit consists of nuts covered by involucra becoming more or less succulent, each containing a solitary suspended seed, in some albumen is present, in others it is abortive.

(1601.) This subtype has been divided into two, viz. the true *Artocarpidæ*, in which the nuts are external, as in the mulberry and the bread-fruit, and the *Ficidæ*, in which they are included within the enlarged succulent receptacle, as in the fig; but such a distribution seems scarcely to be needed.

(1602.) The bread-fruit and the jaca are the two most important species of *Artocarpus*. The former is celebrated not only for its economical value, but for the extraordinary mutiny of Christian and his comrades, the crew of the Bounty under Captain Bligh, who had been commissioned to convey this plant from the islands of the South Seas to those of the West Indies. The kind intentions of the government, which were thus for a time frustrated, were subsequently completed by the Providence, under the same commander; upwards of 1200 bread-fruit trees being transported from Tahiti, and distributed among our various colonies, in St. Helena, St. Vincent, Jamaica, &c. whence they have spread over different parts of South America.

(1603.) The bread-fruit tree (*Artocarpus incisa*), grows to the size of a large apple-tree or small oak, and bears its fruit in round catkins, varying from the size

A. *Artocarpus incisa*. Branch shewing fruit and leaves. (*a, b*) Monochlamydeous stamineous flowers separated. (*a*) The calyx entire. (*b*) Ditto cleft, to shew the filament of the stamen. (*c*) Pistilline flowers set closely side by side. (*d*) Section of the fruit. (*e*) The seed with its tegument.

B. *Humulus Lupulus*. Upper branch bearing pistilline flowers in strobiliform catkins, lower branch stamineous flowers in loose aments. (*a*) Stamineous flower separated. (*b*) An anther. (*c*) Pistilline flower in the axilla of a bracte of the strobiliform ament. (*d*) Pistilline flower separated, to shew its germen, style, and stigmata.

of a child's head to that of a man's. Dampier, who first described it, in 1688, says its fruit "is as big as a penny loaf when wheat is at 5*s*. the bushel; it is of a round shape, and hath a thick tough rind; when the fruit is ripe, it is yellow and soft, and the taste is sweet and pleasant. The natives of Guam use it for bread. They gather it when full grown, while it is green and hard; then they bake it in an oven which scorcheth the rind, and makes it black, but they scrape off the outside black crust and there remains a tender thin crust; and the inside is soft, tender, and white, like the crumb of a penny loaf. There is neither seed nor stone in the inside, but all of a pure substance, like bread. It must be eaten new, for if it be kept above twenty-four hours it grows harsh and choky, but it is very pleasant before it is too stale. This fruit lasts in season eight months in the year, during which the natives eat no other sort of bread." It is evident, from the above quotation, that Dampier's description relates to the seedless variety, which is alone now cultivated, on account of the nuts having accidentally, or from long culture, become abortive; for in its natural state the fleshy head is thickly set with 2 or 300 seeds, that, when boiled or roasted, are eaten as chesnuts. This variety is

propagated by suckers, and the produce of two or three trees will suffice to support a man. The fruit is gathered before fully ripe, for when mature it quickly runs into decay. The ripe fruits are made into a sort of conserve or sourish dough, called *matie*, upon which the natives of Tahiti, and other places where they grow, feed during the time the trees are out of bearing.

This, which Dr. Solander scrupled not to call the most useful vegetable in the world, was well calculated to excite the philanthropic enthusiasm of the worthy naturalist; but, although most important to the half-civilized nations of the southern hemisphere, it is very doubtful if it would be relished here, even if our climate would allow its culture, for the negroes of the West Indies prefer bananas to the bread-fruit for common food: indeed, it seems to be more relished by the Europeans than the slaves; the former consider it as a kind of dainty, and make it into puddings. Some persons compare its flavour to that of the truffle or chesnut, others to that of the potatoe, or Jerusalem artichoke.

(1604.) The milk-like sap of these trees affords a viscid substance resembling bird-lime or caoutchouc, which is used as a ement, and for stopping cracks in vessels designed for holding water. The broad leaves are employed to wrap up the fruit in, and also as plates, dishes, and napkins for the guests to wipe their hands on. The inner bark is beaten out into cloth, such as is common in the South Sea Islands, and more is made from this tree than from the paper-mulberry. The timber, which is light, is used for building boats and houses, and the stamineous catkins form a substitute for tinder.

(1605.) The fruit of the jack or jaca tree (*A. integrifolia*), although larger than the bread-fruit, sometimes weighing upwards of thirty pounds, is of a far less delicate flavour, and is much less esteemed as food. The seeds are, like those of the preceding species, eaten when roasted or boiled, and are said to have an agreeable taste.

(1606.) *Broussonetia*, a genus separated from Morus, and dedicated by Heritier to the memory of his countryman M. Broussonet, contains two species of some economical importance, viz. *B.* (or Morus) *tinctoria*, a native of South America (especially the Brazils), and the West Indies, the wood of which, called *Fustick*, forms one of our most common yellow dies; the timber is hard and strong, but brittle. The second species referred to is the *B. papyrifera* or paper-mulberry, from which the Chinese and Japanese manufacture paper, and the Polynesians their finer kinds of cloth, that are made into garments for the nobles and higher ranks of such semibarbaric society, the cloth of the Artocarpus being chiefly worn by the common people.

(1607.) In China this plant is cultivated as osiers are with us; and the inner bark, when stripped from the rods and separated from the cortical portion, is soaked in water until it becomes soft, is more or less frequently washed and accurately sorted, according to the quality of the paper to be made, then beaten into a pulp with wooden mallets, and, when mixed with an infusion of rice and manihot-root, the liquid paper is poured out into sheets, and when pressed the operation is complete. The refuse matter sorted from the finer and whiter papers, is made into a coarser kind, and when the outer bark is not well separated, a very coarse brown paper is produced.

(1608.) The juice of this tree is so tenacious that it is used in China as a glue, and also as size, in gilding various ornaments. The leaves are not fit for the food of silkworms.

(1609.) Of the mulberry there are several species, valuable for their fruit, their leaves, and their wood. The timber is close, strong, and in water as durable as oak, but it is of very slow growth: the bark is tough and fibrous, and is made into strong mats and baskets. But the leaves are of much more commanding importance, as furnishing food to silkworms, (the larvæ of the Phalæna Mori.) For this purpose they are cultivated largely in China, Japan, and the East Indies, as well as in Italy, and the South of France. In England, although several attempts have been made to naturalize the silkworm, they have been hitherto unsuccessful. Perhaps our climate is too uncertain to render such adventures profitable, or perhaps the occupation is more fitted to the half-indolent natives of warmer latitudes than to the laborious population of our own.

(1610.) The late season of the year at which the mulberries develop their leaves may be one reason why they are the favorite food of silkworms, for these larvæ will feed on the leaves of other trees, such as the ash, and even lettuce leaves are occasionally given them when any scarcity of their ordinary food occurs. The mulberry thus keeping its buds closed until the season is so far advanced, that in the ordinary course of nature neither frost nor any very severe weather may be expected, has caused it to be regarded as the wisest of trees; and heralds consider it as an hieroglyphic of wisdom, whose property (as Gwillim says) "is to speak and do all things in opportune season;" and in sacred history it is recorded as a remarkable instance of the Divine displeasure, that in his wrath the Almighty destroyed the "mulberry trees with frost." A simple, but to those acquainted with natural phenomena, a most emphatic mode of expression, for they drop their leaves at the first severe accession of cold.

(1611.) The white mulberry is chiefly cultivated for the value of its leaves, its fruit being insipid, and very inferior in flavour to that of the common species, the leaves of which are equally good with those of the white, and in some parts of Spain and Persia preferred to them, as the food of silkworms. It is likewise a more hardy tree, having perhaps become callous when, as the fable tells us, it changed the colour of its fruit from white to a dark-red hue, on absorbing the blood of Pyramus and Thisbe, self-slain beneath its shade. It is remarkable that the old mulberry-trees bear larger and finer fruit than the young ones, and that for some years after they begin flowering they put forth only stamineous blossoms.

(1612.) Its mild acidity renders the mulberry an exceedingly grateful fruit, especially to persons labouring under fever. It is slightly laxative, and, like the raspberry and strawberry, is said not to undergo the acetous fermentation in the stomach: and hence it may be more safely eaten by gouty patients than many other fruits which have not the same anti-fermentative properties.

The root of the white mulberry is said to be an excellent vermifuge; and Desbois and Rochefort state that the decoction in the dose of three or four ounces has been known to dislodge the tape-worm. The bark of the common mulberry is reputed to be possessed of cathartic powers, and to be an anthelmintic likewise. Several other species of mulberry yield eatable fruits: that of M. tartarica is made into a conserve in Russia, and it is also fermented into wine.

(1613.) The trumpet-wood, Cecropia, (from κεκράγω or κραζω, to cry out,) has been so named on account of the hollowness of the stems and branches, which (the septa that divide them being removed,) are converted into wind instruments; the wood being light, the trunk is frequently made into fishing-floats, and the tough fibrous bark into cordage. The ligneous part of the plant when dry is very prone

to ignite on simple attrition; and of this property the native Indians have taken advantage, for they constantly light their fires by rubbing a piece of dry cecropia against some harder wood. It is not improbable that the spontaneous combustion of forests may be often attributable to the friction of the branches of these trees against one another by the wind. The sap yields caoutchouc, and both the stems and branches contain much fixed salt, which is used to despumate and granulate sugar. The fruits are crowded together, like the acini of our raspberries, which they resemble in flavour when ripe, and are very pleasant to most European palates; they are also a favorite food of pigeons and other birds. An infusion of the leaves and buds is said to be an antidote against the poison of the *Passiflora quadrangularis*, and it is also employed with advantage as an astringent wash to unhealthy ulcers.

(1614.) The bread-nut is a species of *Brosimum*, (B. Alicastrum) the generic name, (from Βρωσιμος,) being indicative of its use as food. The nuts abound with wholesome farinaceous matter, and, when boiled or roasted, are a very nutritious and agreeable vegetable, eaten by the negroes with beef, pork, or other meat. The young shoots afford good fodder for cattle, who soon become very fond of them, although at first they are not relished on account of the large quantity of gummy matter they contain. This plant abounds with a tenacious milky sap: and the celebrated cow-tree of Humboldt, the palo di vacca of the South Americans, which, when tapped, yields an abundant supply of rich and wholesome milk, belongs to a genus allied to Brosimum, to which Kunth has given the significant name of *Galactodendron utile*.

(1615.) The different species of *Dorstenia*, once much extolled for their alexipharmic virtues, whence indeed one was named the Contrayerva, are now little employed in medicine; they are slightly aromatic and tonic, but so slightly as not to be regarded as of much value. The obscure flowers, and strange mode of inflorescence, which, as Linnæus and Smith remark, are as obsolete in their appearance, and have as little to recommend them as the works of Dorsten, to whose memory the genus has been dedicated, are physiologically interesting, as being the intermediate stage between the external exposed inflorescence of the true *artocarpidæ*, and the internal or concealed fructification of the *ficidæ;* for, in the early stage, the enlarged receptacle is closed, although subsequently it opens into a table-like expansion.

(1616.) The *F. Carica* or common fig, and *F. elastica* or Indian-rubber tree, are the most important species of the genus *Ficus*, the former as a dietetic plant, the latter for the caoutchouc with which it abounds. Several other species, both of this and kindred genera, yield this valuable and curious substance, that is daily becoming of more and more economical importance. Even now, although for such a comparatively short time known, and for a still shorter rendered generally subservient in the arts, a volume might be written on the purposes to which it is applicable, or has already been applied.

(1617.) The common fig, originally a native of the East, and abounding in *Caria*, whence the specific name *Carica*, has been naturalized for immemorial ages in various parts of Africa and Asia, whence it spread into Greece, and thence into Spain, Italy, and other parts of Europe. The great estimation in which the fig was held in former times may be presumed from the frequent mention that is made of it in the earliest traditions and most ancient records we possess. The leaves of the fig-tree formed the aprons with which our first parents clad them-

selves in Paradise. Figs are mentioned among the choice fruits of Canaan, the Promised Land flowing with milk and honey; and, in after ages, the want of blossom

A. *Ficus Carica.* Branch shewing leaves and fruit.

(*a*) Section of the enlarged hollow connivent receptacle, to shew the included flowers.

(*b*) Pistilline flowers, separated to shew the calyx, germen, style, and stigmata.

(*c*) Ditto in an advanced stage, shewing the ovule.

(*d*) Section of the seed.

(*e*) The curved embryo detached.

of the fig-tree was considered as one of the most grievous calamities by the Jews. Cakes of figs were included in the presents of provisions by which the widow of Nabal appeased the wrath of David. In Greece, when Lycurgus decreed that the Spartan men should dine in a common hall, flour, wine, cheese, and figs, were the principal contributions of each individual to the general stock. The Athenians considered figs an article of such necessity that their exportation from Attica was prohibited; and when Xerxes invaded Greece, one of the advantages which he proposed as the result of his expedition was, that he should have unlimited supplies of Attic figs. Either the temptation to evade the law which prohibited the exportation of figs from Attica must have been very great, or it must have been much disliked; for the name which distinguished those who informed against the violators of the law *συκοφανται*, (from *συκον*, a fig, and *φαινω*, to shew,) became a term of reproach, from which we obtain our word sycophant. As used by our older writers, sycophant means a tale-bearer; and the French employ the word to designate a liar and impostor generally—not a flatterer merely. At Rome the fig was carried next to the vine in the processions in honour of Bacchus, as the patron of plenty and joy: and Bacchus was supposed to have derived his corpulency and vigour, not from the vine, but from the fig.

The Romans, knowing the great nutritious power of this fruit, lessened the rations of their slaves during the fig season. The wrestlers fed also on figs to strengthen themselves, and pigs and geese were fattened on them; the latter especially were fed on figs when it was desired to enlarge the liver as a delicacy. All these circumstances indicate that the fig contributed very largely to the support of man; and we may reasonably account for this from the facility with which it is cultivated in climates of moderate temperature. Like the cerealia,

it appears to flourish in a very considerable range of latitude; and even our own country frequently produces fine fruit without much difficulty in the open air, especially in the southern counties. Yet, from prejudice, probably from the fig having been once a common vehicle for poison, it is not so much cultivated here as it might be; although it is still confessed that it belongs to more genial climates to realise the ancient description of peace and security, which assigns these best blessings of heaven to "every man under his own fig-tree." Veg. sub. Lib. E. K.

(1618.) Figs form an important article of Levantine commerce, and between 800 and 1000 tons are annually imported into Great Britain alone, principally from Turkey. Smyrna is a great fig mart; and Madden, in his travels, gives the following lively and amusing account of the interest they there excite.

"In Smyrna the subject of figs is ever the *fruitful* theme of conversation. You ask about the gardens of Bournabul, and you hear that figs abound there; you inquire about the curiosities of that place, and they lead you to the fig-mart; nay, solicit information on politics, and you are told that figs are low; and when you seek for further intelligence, you are told that 'figs are flat.' In short, go where you will, the eternal cry is figs! figs! figs! and the very name, I apprehend, will be found written on their hearts at their decease. A more disgusting operation than the packing of figs I never witnessed. In an immense warehouse the fruit lay strewed over the floor, and fifty or sixty squalid women with mewling infants sat squatted on the heap, picking and stretching the fruit, and overcoming its tenacity with saliva and manipulation. I saw the dirty children mawling the figs; and got out of the way as quickly as I could lest I should witness anything worse. I made a vow against figs."

(1619.) Figs are demulcent and slightly laxative; they have been long used in domestic medicine as favorite poultices. This probably arose from King Hezekiah's boil having been cured by a lump of figs, applied according to the directions of Isaiah. This was 260 years before the time of Hippocrates, and is the most ancient cataplasm of which history makes mention. In the Canaries, in Portugal, and in the Greek Archipelago, a kind of brandy is made from figs. The leaves of *F. racemosa* are esteemed astringent and tonic, those of *F. septica* possess emetic and antiseptic powers. The fibrous bark of *F. cannabina* is used instead of hemp. The rough leaves of *F. angulosa* and *F. politoria* are employed by turners to polish ivory and brass, and the wood of F. carica, because it is light and porous, easily absorbing oil, is used by armourers and workers in steel to clean and polish their goods. *F. tinctoria* affords a red dye to the inhabitants of Tahiti. *F. toxicaria* seems remarkable among so many wholesome species for yielding a sap that is a violent poison; but it must be noted that the juices of several plants that bear wholesome fruit is acrid.

(1620.) The banian or pagod tree of the Hindoos is the *F. religiosa*, so called from its dedication to superstitious observances, and the reverence in which it is held. It is indeed a most wonderful and venerable tree, not only rising to a majestic height, and spreading its huge arms through a vast expanse, but at intervals sending down roots from its branches which, entering the ground, corroborate the parent trunk, and convey unlimited supplies of nourishment from the soil. Fifty, sixty, or even an hundred of these adventitious stems, are not uncommon to a single tree; one at Revel-gong, a friend lately returned from India tells me, covers more than half an acre, and others are known still larger; for the celebrated banian of Cubbeer-bur, when measured by Mr. Forbes, was 2000 fee

in circumference, tracing only round the principal stems. The overhanging ones, not then struck down, covered (says Mr. Forbes) a much larger space. The chief trunks of this single tree, greatly exceeding in size our common oaks and elms, were 350 in number, and the smaller stems amounted to more than 3000, every one of which was casting out new branches and hanging roots, to form further trunks, and become the parents of a future progeny. Cubbeer-bur was for ages famed throughout Hindustan for its great extent and beauty; and it is said that 7000 persons have found ample room to repose beneath its shade. Another Banian is mentioned by an old writer, which is said to have covered five acres of ground. Strabo, Pliny, and other ancient authors, have attempted in their works minute and accurate accounts of this tree; but Milton has perhaps given a more graphic description in fewer words than any other writer:

> "The fig-tree; not that kind for fruit renowned;
> But such as at this day to Indians known
> In Malabar or Deccan, spreads her arms,
> Branching so broad and long, that in the ground
> The bending twigs take root, and daughters grow
> About the mother tree, a pillared shade
> High overarched, with echoing walks between."

(1621.) *Antiaridæ.* The celebrated Upas of Java, the *Boom* or *Bohun Upas* of the natives, is the *Antiaris* or *Ipo toxicaria* of Leschenault and Persoon. The tree is named *Antiar* or *Antschar* by the Javanese, and the poison procured from it (as well as other deadly poisons, such as the Upas Tieuté, of which more hereafter,) is called *Upas* or *Oupas* in Java, and *Ipo* in Macassar, Borneo, and the neighbouring isles. Hence the first generic name is the one to be preferred. The history of the *Upas* affords a melancholy instance of the degree to which a love of the marvellous, and the passion for telling mysterious tales, by which a short-lived fame may be enjoyed, to be succeeded however by enduring contempt, will mislead even well-educated men; for in the relation of Foërsch falsehood was so craftily blended with truth, that his story, although received at first with caution, was, from its very circumstantial details, for years esteemed, notwithstanding its wonderful character, as an authentic record. But, since his many wilful misrepresentations have been detected, even those parts of the narration which are true, or based on truth, have been doubted, and the whole regarded as a cunningly devised fable. The researches of modern travellers of credit have, however, established the existence of the *Upas-tree;* and other very recent investigations have assured us of the reality of the *Upas valley* also. The collation of these two series of facts will put us in possession of the chief materials whence Foërsch composed his tale, and expose the temptation by which he was seduced to declare that he had himself seen those things of many of which he had only heard, and which, marvellous enough as they are, the ignorance and superstition of the narrators had probably in the first place exaggerated, but which he seems to have conjoined for the sake of effect, and to have still further estranged from truth. The circumstances alluded to are in themselves most curious, and their coincidence in Java affords so strange an apparent corroboration, and at the same time so clear a refutation of Foërsch's romance, that it seems to gather from them an importance not properly its own; and as the bear-

ings of the question cannot be well understood without reference to the original story, it may be excusable to make some extracts from a tale, which would otherwise be well forgotten.

(1622.) Description of the poison-tree of Java. Translated from the original Dutch of N. P. Foërsch:

"This destructive tree is called in the Malayan language Bohun Upas, and I must acknowledge that I long doubted of its existence, until a stricter inquiry convinced me of my error. I shall relate only simple unadorned facts, of which I have been an eye-witness; my readers may depend on the fidelity of my account. In the year 1774 I was stationed at Batavia, as a surgeon, in the service of the Dutch East India Company. During my residence there I received several accounts of the Bohun Upas, and the violent effects of its poison. They all seemed incredible to me, but raised my curiosity to so high a degree, that I resolved to investigate this subject thoroughly, and to trust only to my own observations.

"I procured a pass to travel through the island from the governor-general, and a recommendation from an old Malayan priest to another priest who lived on the nearest habitable spot to the tree, which is about fifteen or sixteen miles distant, and who is appointed by the emperor to reside there, in order to prepare for eternity the souls of those who, for different crimes, are sentenced to approach the tree, and to procure the poison.

"The Bohun Upas is situated in the island of Java, about twenty-seven leagues from Batavia, fourteen from Sonra Charle, the seat of the emperor, and between eighteen and twenty from Tinkjor, the present residence of the sultan of Java. It is surrounded on all sides by a circle of high mountains and hills, and the country round it, to the distance of ten or twelve miles from the tree, is entirely barren. Not a tree nor a shrub, nor even the least plant of grass, is to be seen. I have made the tour all round the dangerous spot, at about thirteen miles distant from the centre, and I found the aspect of the country on all sides equally dreary. The easiest ascent of the hill is from the part where the old ecclesiastic dwells. From his house the criminals are sent for the poison, into which the points of all warlike instruments are dipped. It is of high value, and produces a considerable revenue to the emperor.

"The poison which is procured from this tree is a gum that issues out between the bark and the tree itself, like the camphor. Malefactors, who for their crimes are sentenced to death, are the only persons who fetch the poison; and that is the only chance they have of saving their lives. After sentence is passed upon them by the judge, they are asked in court whether they will die by the hands of the executioner, or go to the Upas-tree for a box of poison. They commonly prefer the latter alternative, as there is not only some chance of preserving their lives, but also a certainty in case of their return, that, provision will be made for them in future by the emperor. They are provided with a silver or tortoiseshell box, into which they are to put the poisonous gum, and are properly instructed how to proceed while they are upon the dangerous expedition. Among other particulars, they are always told to attend to the direction of the wind, as they are to go to the tree before the wind, so that the pestilential smell may be blown from them; they are told likewise to travel with the utmost dispatch, as that is the only method of effecting a safe return. They are afterwards sent to

the house of the priest, to which place they are commonly attended by their friends and relations; here they generally remain for some days, in expectation of a favorable breeze, during which the ecclesiastic prepares them for their future fate, by prayers and admonitions. When the hour of their departure arrives, the priest puts on them a long leather cap, with two glasses before their eyes, which generally comes down to the breast, and also provides them with a pair of leather gloves: they are then conducted by the priest and their friends and relations about two miles on their journey. Here the priest repeats his instructions, and tells them where they are to find the tree; he shews them a hill which they are to ascend, and tells them that on the other side they will find a rivulet, which they are to follow, and which will conduct them directly to the Upas; they now take leave of each other, and, amidst prayers for their success, the delinquents hasten away.

"The worthy old ecclesiastic has assured me that during his residence there, for upwards of thirty years, he had dismissed about 700 criminals in search of poison, and that scarcely two out of twenty have returned. He shewed me a catalogue of the unhappy sufferers, with the dates of their departure. I was present at some of the melancholy ceremonies, and desired different delinquents to bring with them some pieces of the wood, or a small branch, or some leaves of the wonderful tree. I have also given them silk cords, desiring them to measure its thickness. I never could procure more than one or two dry leaves, that were picked up by one of them on his return; and all that I could learn of him was, that the tree stood on the bank of the rivulet, that it was of a middling size, that five or six young trees of the same kind stood close by it, but that neither shrub nor plant could be seen near it; and that the ground was of a brownish sand, full of stones, almost impracticable for travelling, and covered with dead bodies.

"After many conversations with the old Malayan priest, I questioned him about the first discovery, and asked his opinion of the dangerous tree, upon which he gave me the following answer:

"'We are told, in our new Alcoran, that above one hundred years ago, the country round the tree was inhabited by a people strongly addicted to the sins of Sodom and Gomorrah, when the great prophet Mahomet, determined not to suffer them to lead such detestable lives any longer, he applied to God to punish them, upon which God caused the tree to grow out of the earth, which destroyed them all, and rendered the country for ever uninhabitable.' Such was the Malayan opinion. I shall not attempt a comment; but must observe that all the Malayans consider the tree as the holy instrument of the great prophet to punish the sins of mankind.

"But, to return: however incredible it may appear, it nevertheless is certain, that from fifteen to eighteen miles round this tree, not only no human creature can exist, but that in this space of ground no living animal of any kind has ever been discovered. I have also been assured by persons of veracity that there are no fish in the water, nor has any rat, mouse, or other vermin, been seen there; and, when any birds fly so near the tree that the effluvia reach them, they fall a sacrifice to the poison. This has been attested by delinquents, who, on their return, have seen them drop down, and brought them to the old priest. I have said that malefactors are instructed to go to the tree with the wind, and to return against it. When the wind continues to blow from the same quarter, while the delinquent travels thirty or thirty-six miles, if he be of a good constitution, he

certainly survives; but, what proves most destructive is, that there is no dependence on the wind in that part of the world for any length of time; it never blows a fresh, regular gale, but is commonly a current of light soft breezes, which make their way through the different openings of the adjoining mountains.

"In the year 1776 I was present at the execution of thirteen criminals, wives of the sultan, condemned to death for incontinence. It was in the forenoon when they were led into an open space; there the judge passed sentence upon them, by which they were condemned to suffer death by a lancet poisoned with Upas. Thirteen posts had been previously erected, each about five feet high, to which they were fastened, and their breasts stripped naked; in that situation they remained a short time in prayer, until a signal was given by the judge to the executioner, on which the latter produced an instrument much like the spring lancet used by farriers for bleeding horses; with this instrument, it being poisoned with the gum of the Upas, the unhappy culprits were lanced in the middle of their breasts, and the operation was performed on all in less than two minutes. My astonishment was raised to the highest degree, when I beheld the sudden effects of the poison, for in sixteen minutes by my watch, which I held in my hand, all the criminals were no more: their pain began in five minutes after the wound was inflicted, and continued increasing till death released them from their sufferings."

(1623.) Thus far the historical romance. The facts ascertained by different travellers, and confirmed on many hands, are the following. The *Antiar* or *Bohun-Upas*, is a native of Java and the neighbouring isles, growing to a large size, and being found not in barren districts, but in the most fertile places. So far from destroying other vegetables, climbing plants twist round its stem as they do round other trees; neither are its exhalations so noxious as to destroy birds flying over or animals that approach it; yet, although neither M.M. Deschamps and Leschenault experienced any inconvenience, other persons are said to suffer from headach, and to have uncomfortable sensations when in its vicinity, similar to those which are produced by the exhalations of the *Manchineel tree*, the *Rhus radicans*, and other plants, especially some of the *Euphorbiaceæ*. Leschenault even smeared some of the venomous juice over his hands with impunity, but he washed them immediately afterwards. The sap which exudes from wounds made in the tree is a bitter gum-resin. It is of a light hue when drawn from the young branches, and dark yellow if taken from the old stem, but both kinds become nearly black on drying. The Javanese make a mystery of its preparation, and pretend that the fresh sap is inert, and that it gains its power by certain additions they make to it, and the process it undergoes. But Hoosfield has shewn that these pretensions are false. In Java the poison is kept in a semi-fluid state, resembling treacle, while in Borneo it is rendered solid. It is usually preserved in the hollow joints of the bamboo, and, if excluded from the air, retains its extraordinary powers for an unlimited time.

The natives use the *Upas antiar*, as well as the *Upas tieuté*, to poison their arrows, both those which are destined for war and the chase; and, before their conquest of Java, the Dutch suffered severely from wounds inflicted by these deadly weapons.

(1624.) This *Upas* or poison of the Antiar, has been frequently mistaken for the Upas or poison of the *Tieuté*, and is still in works of recent publication con-

founded with it: even the analysis of the one has been given for that of the other, and Strychnia, which confers its virulence on the latter, is said to be the active ingredient of the former; whereas it contains no strychnia at all, as the analysis of M.M. Pelletier and Caventou have proved. These celebrated chemists attribute its poisoning powers to a new alkaloid, hitherto unnamed, which they believe to exist in combination with a bitter matter, and which is soluble in alcohol.

(1625.) Animals wounded with envenomed instruments are seized with violent convulsions, followed by spasmodic evacuations of every kind, and die in a tetanic state. Death occurs at different periods, from eight or ten minutes to two or three hours, according to the size of the animal. In one series of experiments, an ape died in seven minutes, mice in ten, a cat in fifteen; but a buffalo lived two hours and ten minutes after the introduction of the poison.

(1626.) This is said by Christison to be one of the poisons that act violently on the heart; for if the body of an animal be examined immediately after death from Upas Antiar, the heart is found to have lost its irritability, and the left ventricle to contain florid blood.

The flesh of animals killed by this poison is not rendered unwholesome, and is eaten by the Javanese.

(1627.) The most circumstantial account of the *Upas Valley* is that communicated to the Royal Geological Society, in November, 1831, by Mr. Barrow, which seems to be derived from the notes of a Journal kept during a residence in Java by Mr. Loudon, extracts from which have been also published by Professor Jameson, in his Journal.

(1628.) This valley of death is called in the Javanese tongue *Guevo Upas* or the Poison Valley, and of it Mr. Loudon gives the following account:

"Balor, 3d July, 1830. This evening, while walking round the village with the pattet, (native chief,) he told me that there was a valley, only three miles from Balor, that no persons could approach without forfeiting their lives, and that the skeletons of human beings, and of all sorts of beasts and birds, covered the bottom of the valley. I mentioned this to the commandant, M. Van Spreewenberg, and proposed our going to see it: M. Daendels, the assistant resident, agreed to go with us. At this time I did not credit all that the Javanese chief told me. I knew that there was a lake close to this that it was dangerous to approach too near, but I had never heard of the Valley of Death.

"Balor, 4th July. Early this morning we made an excursion to the extraordinary valley called by the natives 'Guevo Upas,' or Poisoned Valley: it is three miles from Balor, on the road to the Djiang. M. Daendels had ordered a footpath to be made from the main road to the valley. We took with us two dogs and some fowls, to try experiments in this poisonous hollow. On arriving at the foot of the mountain, we dismounted, and scrambled up the side about a quarter of a mile, holding on by branches of trees, and we were a good deal fatigued before we got up, the path being very steep and slippery, from the fall of rain during the night. When within a few yards of the valley, we experienced a strong, nauseous, suffocating smell; but, on coming close to the edge, this disagreeable smell left us. We were now all lost in astonishment at the awful scene before us. The valley appeared to be about half a mile in circumference, oval, and the depth from thirty to thirty-five feet; the bottom quite flat; no vegetation;

but some very large (in appearance) river stones; and the whole covered with the skeletons of human beings, tigers, pigs, deer, peacocks, and all sorts of birds. We could not perceive any vapour or any opening in the ground, which last appeared to be of a hard, sandy substance. The sides of the valley, from the top to the bottom, are covered with trees, shrubs, &c. It was now proposed by one of the party to enter the valley; but at the spot where we were this was difficult, at least for me, as one false step would have brought us to eternity, and no assistance could be given. We lighted our cigars, and, with the assistance of a bamboo, we went down to within eighteen feet of the bottom. Here we did not experience any difficulty in breathing, but an offensive nauseous smell annoyed us. We now fastened a dog to the end of a bamboo eighteen feet long, and sent him in; we had our watches in our hands, and in fourteen seconds he fell on his back, did not move his limbs or look round, but continued to breathe for eighteen minutes. We then sent in another, or rather he got loose from the bamboo, but walked in to where the other dog was lying; he then stood quite still, and in ten seconds he fell on his face, and never moved his limbs afterwards; he continued to breathe for seven minutes. We now tried a fowl, which died in one minute and a half. We threw in another, which died before touching the ground.

"During these experiments we experienced a heavy shower of rain, but we were so interested by the awful scene before us that we did not care for getting wet.

"On the opposite side, near a large stone, was the skeleton of a human being, who must have perished on his back, with his right arm under his head: from being exposed to the weather, the bones were bleached as white as ivory. I was anxious to procure this skeleton, but any attempt to get at it would have been madness.

"After remaining two hours in the Valley of Death, we returned, but found some difficulty in getting out. From the heavy shower, the sides of the valley were very slippery, and, had it not been for two Javanese behind us, we might have found it no easy matter to escape from this pestilential spot. On reaching our rendezvous, we had some brandy and water, and left this most extraordinary valley; came down the slippery footpath, sometimes on our hams and hands, to the main road; mounted our horses, and returned to Balor, quite pleased with our trip.

"The human skeletons are supposed to have been rebels, who had been pursued from the main road, and had taken refuge in the different valleys; as a wanderer cannot know his danger till he is in the valley, and, when once there, one has not the power or presence of mind to return.

"There is a great difference between this valley and the Grotto del Cane, near Naples, where the air is confined to a small aperture; while here the circumference is fully half a mile, and not the least smell of sulphur, nor any appearance of an eruption having taken place near it: although I am aware that the whole chain of mountains is volcanic, as there are two craters at no great distance from the side of the road, at the foot of the Djing, and they constantly emit smoke. (Fahr. 52°.)

"In the eighth volume of the Proceedings of the Batavian Society of Arts and Sciences, Dr. Horsfield, of the East India Service, gives a description of the mineral constitution of the different mountains of Java. He examined several

parts of the chain of hills, and states that he heard of this valley, but that he could not prevail on the natives to shew him where it was.''

(1629.) There is indeed, as Mr. Loudon observes, a great difference between this Valley of Death in Java, and the Grotto del Cane near Naples, in their size, but not that difference he seems to hint at, as to the nature of the destroying gases to which they owe their celebrity; for, although it has frequently been asserted, and the assertions lately repeated, that the grotto is a cave emitting powerful sulphureous exhalations, and that those who enter are comparatively choked or stifled by the 'sulphuric fumes,' the vapours contain neither sulphur nor sulphuretted hydrogen, nor any sulphuric combinations. This was shewn by my friend Mr. Alfred Taylor, who made a series of experiments on the air contained in the grotto, which he found to be carbonic acid mixed with 0·06 of atmospheric air. (Vide Med. and Phys. Journal, October 1832.) The Valley of Death would therefore seem to be a Grotto del Cane on a most gigantic scale; for in the neighbourhood of both there are proofs of volcanic action, and a figure, illustrating the mode in which the heavy carbonic acid is retained in the one, will serve also to shew how the much larger volume of the same life-destroying gas is confined in the bason-like hollow of the other.

Sectional View of the Grotto del Cane.

D. The entrance. (*b*) The level of the gas restrained by the rise (*a*), at the mouth of the cave. (*c*) The fissures in the trificeous rock by which the gas enters.

(1630.) The origin of Foërsch's centaurian tale must now be evident: that Upas meant poison, and was an adjective term applied to deleterious things of various kinds, whether trees or places, he knew not; he had heard of the *Upas*, had probably witnessed its effects as a poison, and not improbably had seen the real Bohun Upas tree, which perhaps may sometimes grow in a barren district, such as he has described. He had heard of the Valley of Death, the Upas valley, and he might even have ridden round some sterile spot for thirty miles, fearing to tread upon its precincts, lest he should approach too closely to the chimera he had formed, by combining the accounts of the *Upas valley* and the *Upas tree*. As to the old priest, he might have heard from him the legend he relates; but for the

numerous other facts used as embellishments to the tale, he must have been solely indebted for them to a fertile imagination.

(1631.) URTICACEÆ. The nettle (*Urtica*), the pellitory (*Parietaria*), the hop (*Humulus*), the hemp (*Cannabis*), and the other genera associated to form this type, are chiefly, though not exclusively, found within the tropics, and in the warmer parts of the temperate zones, as they extend also into the northern regions.

They are for the most part herbs or herbaceous plants, occasionally becoming shrubs and trees, with round and scattered non-lactescent branches. Their leaves (most frequently opposite) are simple, petiolate, stipulate, trifid or scabrous, and often bearing stimuli.

The flowers, chiefly monœcious, sometimes diœcious, polygamous, and even monoclinious, are collected into amentiform spikes, capitula, or panicles. The perianth, when present, is herbaceous, single, lobed, persistent, and imbricate in æstivation. The stamens are definite, either perigynous or hypogynous, and often irritable; and the anthers are 2-celled.

The germen is free, 1-celled, and the ovule solitary and erect, or several attached to parietal placentæ, styles connate or abortive, and stigmata penicillate or pubescent.

The fruit is either an indehiscent utricule or a dehiscent capsule, surrounded by the dry persistent calyx. The seed solitary, erect, or pendulous, albumen fleshy, small, or none. Embryo for the most part straight, occasionally curved or spiral, the radicle superior, and the cotyledons opposite, broad and entire.

(1632.) Hence, differentially considered, the *Urticeæ* are non-lactescent *Urticinæ*, with the fruit free, distinct, and not covered by a succulent pseudocarp; seeds in general erect and solitary, embryo for the most part straight, and the radicle superior.

(1633.) The genera associated in this natural group are distributable into three subtyes, called, from the respective normal genera, *Urtica*, *Cannabis*, and *Lacistema*, the *Urticidæ*, *Cannabidæ*, and *Lacistemidæ*, which differ in the following particulars.

(1634.) In the *Urticidæ* the stamens are distinct, inserted into the base of the calyx opposite the lobes, and are induplicate in æstivation; the anthers dehisce by a longitudinal cleft, and curve backwards elastically. The fruit is a simple indehiscent nut, and the embryo straight.

(1635.) The Cannabidæ differ from the *Urticidæ*, in having the stamina straight in æstivation, and not irritable; the flowers diœcious, the perianth five-parted, and the embryo curved or spiral.

(1636.) The *Lacistemidæ* are more decidedly amentaceous than the two other subtypes; the perianth is more developed; and their flowers are also monoclinious and covered over by a dilated bractea; the stamens are hypogynous and exserted from one side of the ovarium; the connectivum is thick and two-lobed, and the anthers dehisce transversely; the germen contains several ovules, but the fruit by abortion is 1-seeded. The seed is pendulous and arillate, the testa crustaceous, and the albumen fleshy.

(1637.) *Urticidæ*. The obtrusive nettle is a very curious and interesting plant, and the stings or stimuli with which it is covered most admirable pieces of mechanism. In their structure they bear a strong resemblance to the poison-

fangs of the rattle-snake, each consisting of a tubular stilet perforated at or near the fine extremity; and it widens at the lower end into a chamber or receptacle, at the bottom of which, among the cellular substance of the plant, is seated a gland. The gland secretes a juice more or less acrid, and sometimes highly venomous, which is collected in the hollow receptacle, and when an unfortunate finger presses on the tubular stilet, its needle-like point enters the flesh, and the force required for this presses it down on the hollow chamber, so that the poison, therein stored up, rises through the channel of the stilet, and is deposited beneath the cuticle.

(1639.) The English word nettle is an alteration of needle, or at least both have the same Anglo-Saxon root (*Netel, nædl*), and obviously refers to the needle-like stings so common on the plant. The Latin generic word *Urtica* has as obvious a reference to their effects; it is a derivative of *uro*, to burn, and hence *urtica urens*, the name of one of our British species, is a pleonasm.

(1640.) Even our common nettles produce occasionally very painful swellings, and sometimes serious inflammation and blisters on irritable skins. But these are trifling in comparison to those which are the constant effects of being stung by several of the exotic species, such as the *crenulata* and *stimulans*, and especially one which, in Timor, is called *Daoun setan*, or the devil's leaf. M. Leschenault, in the Memoires de Musée (vol. vi. p. 362), has given fearful accounts of these venomous plants. He was himself stung by the *U. crenulata*, the leaves of which were slightly touched by the first three fingers of his left hand, while gathering a specimen for his herbarium. At the time he was stung, seven in the morning, he says he only felt a slight pricking, which he wholly disregarded. But the pain gradually increased, and in the course of an hour it had become intolerable; and, although there was no remarkable external appearance, neither swelling, nor blister, nor inflammation, still the parts felt as if they were being rubbed with a hot iron. The pain soon extended all up the arm, even to the armpit, and about noon he was alarmed by an agonizing contraction of the muscles of the jaws, which made him fear an attack of tetanus. He was also affected with frequent sneezing, attended by a copious running from the nose. So severe were his sufferings that he went to bed; yet relief was thus sought in vain, for the torture continued the whole of the afternoon and night; the symptoms of lockjaw, however, disappeared about seven in the evening, and the following morning, the pain being lessened, he fell asleep. But he was not free from pain for nine days, and it returned in full force whenever he put his hand in water. The effects of the sting of the devil's leaf are still more dangerous and severe; they are said to last for a year, and even occasionally to cause death.

(1641.) The Urticæ, when dried, are readily eaten by sheep and oxen, but in a fresh state they are fed on by few large animals. They are, however, the favorite resort of myriads of insects, and their principal food in the larva state; which may be the final cause of their being distasteful to flocks and herds.

The tops of the common nettle are boiled and eaten in many places as greens, and occasionally they have been cultivated as a culinary vegetable; and it would seem, from the remonstrance of *Andrew Fairservice*, in Rob Roy, that in the north of Scotland they were once well prized; for Scott, the faithful chronicler of human life, has made him say, " Nae doubt I should understand my ain trade of

horticulture, seeing I was bred in the parish of Dreep-daily, near Glasgow, where they raise large kail under glass, and force early *nettles* for their spring kail."

(1642.) A decoction of nettles strongly salted will coagulate milk readily, without giving it any unpleasant flavour. The whole plant is esteemed astringent and diuretic; but is little used in medicine. The roots boiled with alum will dye yarn of a yellow colour. The fibrous texture of the nettle, like that of many other plants contained in this section, is very tough and strong, and might be used as a substitute for hemp. In Siberia and the northern parts of Europe, cords, cloths, and even paper, are made from nettles.

(1643.) The *Parietaria*, or pellitory of the wall, though an officinal plant, possesses very slight sanative powers. It is thought to be a cooling diuretic, and farmers say that if bunches of it are laid upon heaps of corn infested with weevils, it will drive away those destructive insects.

(1644.) *Cannabidæ.* Of hemp (*Cannabis*), there are two principal varieties, esteemed by some persons distinct species, viz. the European hemp, with opposite leaves (*C. sativa*), and the Indian, called in the Peninsula Bang or Banghe (*C. indica*), the leaves of which are alternate. Lamarck states that they likewise differ in their physical properties; but, although from habit devoted to different purposes, it is probable that they do not differ more than other plants would do if grown in such different climates.

(1645.) In India, hemp is cultivated as a luxury, and used solely as an excitant. It possesses peculiar intoxicating powers, and produces luxurious dreams and trances. The leaves are sometimes chewed, and sometimes smoked as tobacco. A stupifying liquor is also prepared from them; and they enter, with opium, betel-nut, sugar, &c. into various narcotic preparations. Prepared hemp is called by the Arabs *Hashish*, by the Hindoos *Banghie*, by the Turks *Malach*, and by the Hottentots, who get drunk with it, like more civilised communities, *Dacha.* Hemp seems to owe its narcotic powers to a gum resin, obtainable in a separate state from at least one variety, and which is called in Nipal *Cheris.*

(1646.) In Europe hemp is largely cultivated, but exclusively for its value in domestic economy and the arts, and not as an intoxicating agent. Its fibres are very tough and strong, and peculiarly adapted for weaving into coarse fabrics, such as sail-cloth and twisting into ropes and cables. Immense quantities are imported into this country for the use of the navy, and large stores kept; for it is not a profitable crop to grow in a well-peopled country, where corn is in great demand. The seeds abound in oil, which is relished by the Russians as food; in other countries it is chiefly used by painters, or to burn. The seeds are very nutritious, and form a favorite food with most birds. But hemp-seed has the very singular property of changing the colour of the plumage of bullfinches and goldfinches from red and yellow to black, if they are fed on it for too long a time, or in too large a quantity.

(1647.) Of the hop (*Humulus Lupulus*), there are several varieties, distinguished by the growers in our Kent and Sussex gardens, but they are all reducible to a single species, the only one hitherto discovered. The present generic name, Humulus, is said to be derived either from *humidus*, wet, or *humus*, fresh damp earth, as hops flourish chiefly in rich moist soils; but these and many other etymologies are anything but satisfactory, the roots of names being often lost

through the lapse of years. The specific denomination, Lupulus, is a corruption of the old name, *Lupus salictarius*, the willow-wolf, as we are informed by Pliny it formerly was called on account of its growing amongst osiers, to which, by twining round, overbearing and choking them, it became as destructive as the wolf to the flock. Our English name, hop, evidently comes from the Anglo-Saxon *hoppan*, to climb, and it is admirably descriptive of the habit of the plant.

(1648.) Hops are grown in large quantities in this country for the purpose of preserving and improving beer, between 45 and 50,000 acres being laid down in two or three counties, such as Kent, Sussex, and Hereford, as hop-gardens.

The duty upon hops, with the uncertainty of the crops, often raises them to an extravagant price; hence the temptation is great to substitute some other bitter for the hop. This is however resisted not only by the excise, as a fraud on the revenue, but still more vehemently resented by the public, who will tolerate in theory no brewing save from 'genuine malt and hops.' But, strong as is the prejudice now in favor of hops, it was once as strong against them; for Walter Blith, in his 'Improver Improved,' published in 1649 and 1653, says "that it was not many years since the famous city of London petitioned the parliament of England against two nuisances; and these were Newcastle coals, in regard of their stench, &c.; and hops, in regard they would *spoyl the taste of drink*, and endanger the people."

(1649.) The hop, and its essential proximate principle, *Lupulin*, are sometimes used medicinally, and hop-pillows have long been favorite sedatives. But the narcotic power of the hop is slight; much less than that of hemp, which well deserves to be tried in this country, as it would probably be a valuable addition to our present list of remedies.

The young shoots of the hop blanched are sometimes eaten as asparagus, for which they form an excellent substitute. From the bines a coarse sacking has been made, and a yellow dye extracted.

(1650.) *Lacistemidæ*. *Lacistema*, formerly included among the Urticidæ, has been made by Von Martius the normal genus of a separate group. The peculiarities of structure already described fully warrant the separation, and this subtype forms an interesting osculant group, connecting the Urticinæ by their amentiform inflorescence and habit with the Piperinæ; and other characters confirm the relationship, especially with the *Chloranthaceæ*.

The Lacistemæ are all tropical plants, the properties of which are unknown, and none of them have hitherto been applied to any useful purpose.

(1651.) Datiscaceæ. *Datisca*, the Cretan hemp, referred by the French botanists to the natural group *Urticeæ*, has been separated by Dr. Brown, and formed, with *Tetrameles*, into a distinct order, concerning the primary affinities of which much difference of opinion prevails. Don and Lindley station it near *Resedaceæ*, to which disposition Bartling strongly objects, and hints at its connexion with the *Cucurbitaceæ*.

That the genera included in the group are allied to the *Urticaceæ* seems however evident, and, although distinguishable, would perhaps be sufficiently distinguished even if admitted only as a subtype: at any rate, until stronger affinities are shewn to any other section, they may be allowed to maintain their station here.

(1652.) The *Datiscaceæ* are large, coarse, perennial, non-lactescent herbs,

strongly resembling hemp, with alternate pinnato-sected leaves, without stipulæ. The flowers are diœcious, from abortion, and arranged in long, spiked axillary racemes. In the stamineous flowers the calyx is divided into several pieces, the stamens variable in number (8—15), and exserted from the receptacle, the anthers 2-celled, introrse, long and protruding. In the pistilline flowers the calyx is superior with a 2-3-toothed persistent limb, ovary 1-celled, formed by three connate carpels, styles 3, short and cleft, stigmata simple, trophosperms parietal and many-ovuled.

The fruit is a 3-valved, 1-celled prismatic capsule crowned with the persistent styles, and having a gaping terminal foramen. The seeds are many, small, roundish, with a finely reticulated integument. The embryo straight, with a fleshy albumen, the cotyledons very short, and the radicle long, thick, and turned towards the hilum.

(1653.) Hence, differentially considered, the *Datiscaceæ* are non-lactescent *Urticinæ*, with alternate exstipulate leaves, regular monœcious flowers, 1-celled hiant ovaries, indefinite ovules, and parietal placentæ.

(1654.) *Datisca cannabina* has very much the appearance of hemp, and its fibres might probably be applied to the same purposes: the species are bitter and decidedly powerful tonics. In Crete and Candia the hemp-like Datisca is used instead of Peruvian bark, and is said to be fully as efficacious in the cure of intermittent fevers. A crystalline principle has been procured by its analysis, which resembles Inuline, and has been called *Cannabine* or *Datiscine;* it has been used to dye yellow.

(1655.) *Monimiaceæ.* The plants included in this type are either trees or shrubs, with simple exstipulate, opposite, petiolate leaves, destitute of stipules.

The flowers are achlamydeous, for the most part monœcious, rarely monoclinious or diœcious, sessile on a common concave, globose or urceolate receptacle, and surrounded with an involucre, the divisions of which are in two rows. The stamina are often interspersed with scales, the filaments frequently biglandulose at their base, the anthers 2-celled and dehiscing longitudinally, either by recurved valves or simple clefts.

The capitula of pistilline flowers are surrounded by an involucre, similar to that of the stamineous ones, and are either definite or indefinite. The germen is free, 1-celled, and 1-ovuled, and the ovules either erect or pendulous.

The fruit consists of 1-seeded nuts, enclosed within the persistent involucre, which occasionally becomes fleshy. The seeds are either erect or pendulous, with a thin testa; and the embryo included within a large, soft, and fleshy albumen.

(1656.) Hence, differentially considered, the *Monimiaceæ* are achlamydeous per-albuminous *Urticinæ*, with involucrate sessile flowers, anthers bursting lengthwise, and opposite exstipulate leaves.

(1657.) The genera associated to form this type are distributable into two subtypes, called, from the respective normal genera, *Amboridæ* and *Atherospermidæ*.

(1658.) The *Amboridæ*, including *Ambora*, *Monimia*, and *Ruizia*, are distinguished by having the anthers dehisce by a simple longitudinal groove, the seeds pendulous, and the radicle superior. While, in their associates,

(1659) The *Atherospermidæ*, the anthers dehisce by recurved valves, the seeds are erect, and the radicle is inferior.

(1660.) The *Monimiaceæ* are found exclusively in the Southern hemisphere, being natives, the first subtype, of South America, and the second of the same continent, and also of New Holland. They are aromatic plants, exhaling a delightful fragrance, likened by travellers to the smell of true laurels and myrtles. They have not hitherto been applied to any useful purposes, and are chiefly interesting at present from being the osculant group between the Urticaceæ, along with which they were formerly arranged, and the *Lauraceæ*, to which, by their aromatic properties, and especially by the extraordinary recurved dehiscence of the anthers in one subtype, they shew no slight affinity.

LAURINÆ.

(1661.) This section includes eight groups of associated genera, called, respectively, the *Lauraceæ*, *Myristicaceæ*, *Hernandiaceæ*, *Thymelæaceæ*, *Peneaceæ*, *Proteaceæ*, *Santalaceæ*, and *Combretaceæ*, to which the laurels (*Lauri*), as the most familiar plants, give the common collective name.

(1662.) The *Laurinæ* are shrubby or arboreous *Querneales*, with exstipulate leaves, a coloured perianth, flowers mostly united,

A. Branch of *Laurus nobilis*, shewing leaves and fruit.

(*a*) A stamen shewing its 2-celled anthers and elastically recurved valves, after dehiscence.

(*b*) Another stamen with one anther closed, the other beginning to burst, and the filament furnished with its 2 basal glands.

(*c*) Section of the fruit, shewing its solitary pendulous seed, without arillus.

(*d*) The exalbuminous embryo with large plano-convex cotyledons, and conspicuous 2-leaved plumule, and short straight superior radicle.

fruit 1 or many-seeded, albumen none, or when present not farinaceous, but either fleshy or ruminated, and the embryo straight.

(1663.) Lauraceæ. The *Bay*, the *Cassia*, the *Cinnamon*, and the *Camphor*, with the *Alligator-pear*, the curious parasitical *Cassytha*, and the other plants associated to form this type, are shrubs or trees, often of a large size, with incom-

plete superficial nodes; the leaves are alternate, (rarely opposite,) simple, coriaceous, exstipulate, and sometimes abortive.

The flowers monoclinious (rarely diclinious), small, and regular.

The perianth is synsepalous, the limb 6-4 cleft, and mostly imbricate in æstivation, deciduous or persistent, and sometimes obsolete. The stamina are definite and perigynous, arising from a torus in two series; the three inner stamens opposite the segments of the calyx barren or abortive, the six outer rarely absent. The inner filaments are furnished at their bases with pedicelled glands. The anthers are terminal, 2-4-celled, and dehisce by recurved valves. The germen is free, 1-celled, and the ovule solitary and pendulous. The style simple, and the stigma obtuse.

The fruit is fleshy and indehiscent, often surrounded or enclosed by an enlarged persistent calyx. The seed is exalbuminous and exarillate; the straight embryo large and inverted, the radicle short and superior, the cotyledons plano-convex, peltate near the base thick and fleshy, and the 2-leaved plumula conspicuous.

(1664.) Hence, differentially considered, the *Lauraceæ* are exalbuminous exarillate Laurinæ, with superior ovaries, definite pendent ovules, and anthers dehiscing by recurved valves.

(1665.) The *Lauraceæ* are distinguishable into two subtypes, the *Lauridæ* and the *Cassythidæ*.

(1666.) The first (viz. the *Lauridæ*), contains the leafy arborescent aromatic species.

(1667.) The second (viz. the *Cassythidæ*), those which are leafless, herbaceous, and insipid.

(1668.) The *Lauridæ* are all aromatic plants, and exceedingly uniform in their properties. They contain essential oil in abundance, which imparts to them a peculiar sweet, though sometimes strong and penetrating odour, and a warm and pleasant taste; hence they yield some of our most grateful stimulants and spices.

(1669.) The old genus, Laurus, has been divided by modern botanists, and its species arranged in three or more genera, or subgeneric groups, called *Laurus*, *Persea*, and *Cinnamomum*, the latter two being sometimes separated and sometimes conjoined.

The first includes the *Bay*, the false *Benzoin*, and other laurels with 2-celled anthers and naked fruit. The second, the *Cassia*, the true *Cinnamon* and the *Camphor*, in which the anthers are 4-celled and the fruit covered. And the third, the *Alligator-pear*.

(1670.) *Laurus nobilis*, the bay, is the only European plant belonging to the type. It is aromatic, like the rest of its associates, and, before the introduction of the exotic species, bay-berries and bay-leaves were much esteemed in medicine. Its use, as forming heroic and academic crowns, has long been also obsolete, though conquerors' statues still often bear a sculptured wreath of barren boughs, while the Baccalaureate degree remains a symbol that the victories of Apollo are more fruitful than those of Mars.

(1671.) *Laurus borbonia* is the true red bay; it yields the Isabella wood, so much prized on account of its satiny appearance, for cabinet-work: and its roots afford a violet dye. The *Laurus Benzoin* or pseudo-benzoin, although it has the smell of Benzoin, does not yield the gum resin of medicine, which is the

produce of a species of styrax. *L. chloroxylon* and *L. indica*, the green-wood, and the royal bays, are both much valued for their timber; the first is hard and tough, and, from its common use in machinery, is called cog-wood; the latter is light, of a yellowish colour, and known as Madeira mahogany.

The Sassafras of medicine, which word is a corruption of the Spanish salsafras or saxifrage, is the wood of the L. sassafras. It is difficult to say why the wood of this species should be preferred to the bark for medicinal purposes, as the latter contains the peculiar principles in much the greatest relative proportion.

(1672.) The alligator-pear is the fruit of the Persea gratissima (*Olim L. Persea,*) alligator being a barbarous corruption of *Avocatier*, to which variety of pear the fruit of the Persea bears some resemblance. In the West Indies it is in much esteem for its rich and agreeable flavour, and is said to be relished not only by man, but by horses, cows, dogs, cats, and all sorts of birds.

(1673.) *Cinnamomum* is said, without much probability, to be an abridgment of *China Amomum*, the bark being one of the most valued spices of the East. Several species afford the cinnamons and cassias of commerce, but the best is the inner bark of *Cinnamomum verum*, (Laurus or Persea Cinnamomum.) Peruvian cinnamon is the bark of *L. Quixos*, and in the Isle of France, and elsewhere, cinnamon is procured from *L. cupularis, Malabathrum, Cinnamomöides*, &c. Camphor is also yielded by several of these plants, especially by the *L. Camfora*, but the largest quantities of this drug are procured from another source, viz. from the Dryobalanops camphora; and Zea tells us that, in South America, he found another tree, from the bark of which camphor exudes in the form of tears.

(1674.) The juices of *L. caustica* are highly irritating, and, according to Molina, even its exhalations will produce painful swellings and cutaneous eruptions, when persons sleep under its shade. The *Laurus culitlawan* is the clove-scented cinnamon; *Kulit*, in the Malay language, signifying bark, and *lawan*, a clove. It is much prized as a perfume and a masticatory in Java. From the fruit of *L. glauca*, a concrete oil or fat is extracted, which is made into candles; and in Ceylon candles are also made from the solid portions of cinnamon oil; for the exclusive use, as I learn from Dr. Gregory, of the king and nobles.

Dr. Hancock has described an essential oil that flows in abundance from a Guiana laurel when the bark is merely wounded, so that several quarts may be readily obtained, and which is a powerful diaphoretic, diuretic, and discutient.

The Pichurim beans are the fruit of *L. Pichurim*, and also, according to Martius, of *Ocotea Puchury*; several species of which latter genus are aromatic and tonic, and one, *O. Cymbarum*, affords the Orinoco sassafras.

(1675.) *Cassythidæ*. *Cassytha*, which is the Greek name for *Cuscuta*, has been given to several curious plants something resembling our Dodders, but having the fructification of the laurels, to the neighbourhood of which they are by all authorities referred. They however differ from them so much in their leaflike twining port and parasitic habits, as well as in their qualities, that they are well distinguished as a subtype of the Lauraceæ. Four or five species of Cassytha are known; they are natives of the tropical forests of Asia, Africa, America, and of New Holland. They are none of them aromatic plants: but one, *C. filiformis*, is used in Senegal as a demulcent.

(1676.) Myristicaceæ. The nutmeg, *Myristica*, with its immediate allies,

Virola, *Knema*, and *Eupomatia*, Dr. Brown has separated from the laurels, to form the present type.

B

B. Branch of *Myristica moschata*, shewing leaves and fruit.

(*a*) Flower separated, shewing the 3-cleft perianth.

(*b*) Stamineous flower, the calyx being removed, shewing the columnar stamens and the simple longitudinal dehiscence of the anthers.

(*c*) Pistilline flower with the calyx removed.

(*d*) Section of the same, shewing the solitary erect ovule.

(*e*) The ripe seed or nutmeg, invested by its cloven arillus or mace, the fleshy pericarp (B) having been removed.

(*f*) Section of the seed shewing the ruminated or marbled albumen, including the erect embryo.

(*g*) The embryo removed, shewing its foliaceous cotyledons and short inferior radicle.

They are all tropical much-branched trees, yielding often a reddish sap. Their leaves are exstipulate, alternate, simple, undivided, entire, petiolate, impunctate, coriaceous, and, when fullgrown, for the most part downy beneath.

The flowers are diœcious, axillary or terminal, and collected into racemes, tufts, or panicles, and invested by a short cucullate bracte. The calyx in the stamineous flowers is coriaceous, often downy without, and smooth within, monophyllus and 8-lobed, with a valvate æstivation; the stamina are subperigynous, definite (3—12), and ternary in their arrangement; the filaments monadelphous; the anthers 2-celled, extrorse, with a simple longitudinal dehiscence, and either free or connate. In the pistilline flowers the calyx is deciduous, the germen free and sessile, formed of a single carpellum, the ovule solitary and erect, the style terminal and very short, and the stigma slightly lobed.

The fruit is fleshy, the sarcocarp bivalved and dehiscent; the seed nut-like, erect, and covered by a many-cleft arillus; the albumen ruminate, sebaceo-carnose, the embryo small, included within the base of the albumen, the radicle inferior, and the cotyledons foliaceous.

(1677.) Differentially considered, the *Myristicaceæ* are diœcious *Laurinæ*, with alternate exstipulate leaves, ternary flowers, definite monadelphous stamens, and ruminated albumen.

(1678.) Of the several species of *Myristica*, the common nutmeg (*M. moschata*), is the most valuable and best known; aromatic fruits are however borne by others, such as the *M. otoba*, which is the nutmeg of Santa Fé, and *M.*

Horsfieldii, which is a native of Ceylon and Java, where there are also found several more varieties or species. The fruit of *M. tomentosa* is often fraudulently mixed with ordinary nutmegs, but it contains much less oil, is far less aromatic, and very inferior as a spice.

(1679.) The commercial history of the nutmeg affords an instance of the extravagance to which the spirit of monopoly will urge, and has carried not only private individuals, but even states. The Banda Isles, which, though very small, are the chief nutmeg-gardens of the world, were first colonized by the Dutch; and, very soon after their subjugation of the original inhabitants, in 1602, they endeavoured to secure to themselves the entire trade in this valuable spice. For this purpose they encouraged the cultivation of the nutmeg in only a few of the islands; and, being over-anxious, for the sake of the monopoly, to have them there exclusively under their own command, they either destroyed the trees themselves in the remainder of the isles, or kept the princes in their pay for the purpose of so doing. In fact, they pursued the same contracted overbearing policy with regard to the nutmeg which they did with respect to the clove. They have more than once, however, suffered dearly for their insatiable avarice; for the dreadful hurricanes and earthquakes, which spared the other islands, nearly annihilated the nutmegs of Banda, in 1778. While the Dutch remained undisturbed possessors of the Spice Islands, the quantity of nutmegs and mace exported from their nutmeg-grounds, circumscribed as they were, was truly enormous. Stavorinus, in his voyage to the East Indies, gives an excellent account of the commerce and history of this spice. A quantity, estimated at no less than 250,000 lbs., was annually vended in Europe, and nearly half that amount in the East Indies. Of mace the average has been 90,000 lbs. sold in Europe, and 10,000 lbs. in the East Indies. When the Spice Islands were taken by the British, in 1796, the importations of the East India Company into England alone, in the two years following the capture, were of nutmegs 129,723 lbs., and of mace 286,000 lbs. When the crops of spice have been superabundant, and the price likely in consequence to be reduced, the same contracted spirit before mentioned has actuated the Dutch to destroy immense quantities of the fruit, rather than suffer the market-price to be lowered. A Hollander, who had returned from the Spice Islands, informed Sir William Temple, that at one time he saw three piles of nutmegs burnt, each of which was more than a church of ordinary dimensions could hold. In 1760, M. Beaumaré witnessed at Amsterdam, near the admiralty, the destruction by fire of a mass of spice which was valued at one million of livres, and an equal quantity was condemned to be burnt on the day following. Mr. Wilcocks also, the translator of Stavorinus's Travels, relates that he himself beheld such a conflagration of cloves, nutmegs, and cinnamon, upon the little island of Newland, near Middleburgh, in Zealand, as perfumed the air with their aromatic scent for many miles around.

The nutmeg has within the last forty years been cultivated by the English at Bencoolen, in Sumatra, and also in the West Indies; in the former situation the plants thrive well, and yield abundant crops, but in the latter the culture does not appear to succeed. Nutmeg-trees have also been introduced into the Isle of France, so that the monopoly of the Dutch has been completely cancelled.

(1680.) Nutmegs contain both a fixed and an essential oil; the former is expressed from the imperfect fruit, unfit for the European market, and commonly known as oil of mace. The best is imported in stone jars, is softish, of a yellow colour,

and agreeable fragrancy, resembling the nutmeg. This is called Banda soap. That which comes from Holland in flat solid masses is a very inferior article, and some of it appears to be adulterated with suet and other extraneous greasy matters. The oil in which the aromatic properties of the nutmeg reside being volatile is easily separable by distillation, and nutmegs are frequently punctured and boiled in order to extract the essential oil, the orifices being afterwards closed with powdered sassafras, and the spice then sent to the markets. These frauds, both with cloves and nutmegs, were once carried on to a great extent, but now the temptation is less, and suspicion being awake, the cheat could scarcely escape detection.

(1681.) The fruit of *Myristica*, now *Virola sebifera*, abounds in oil, which is readily separable by immersing it in hot water, and when the water cools the fat-like oil concretes, and may be thus easily removed for economical purposes.

(1682.) An acrid juice exists in the bark of all these trees, and also in the fleshy or coriaceous pericarp, which is used as a cutaneous irritant in rheumatic affections. The nutmeg or seed, with its arillus or mace, are powerful carminatives, and in large doses they are said to produce intoxication, delirium, and even to bring on apoplexy. They are, however, in proper doses and quantities, most valuable cordial medicines and agreeable wholesome spices. Their consumption is immense in cookery, and they enter into the composition of a great number both of regular and irregular officinal preparations.

(1683.) HERNANDIACEÆ. *Hernandia*, a genus sometimes arranged with the *Myristicaceæ*, from which it differs by its exalbuminous seeds; and sometimes with the *Lauraceæ*, from which it is distinguished by its involucrate flowers, as well as by the simple longitudinal dehiscence of its anthers, is perhaps more closely allied to the *Thymelæaceæ* than to either of the foregoing types; and it becomes therefore questionable whether the group, of which by Blume it has been made typical, should be considered a subtype of *Thymelæaceæ*, or an intermediate type connecting that group with the two preceding, as, in deference to its founder, it is admitted here.

(1684.) The *Hernandiaceæ* are arboreous plants, with simple, entire, alternate, exstipulate leaves, coriaceous and impunctate.

Their flowers are monoclinious or monœcious, collected into axillary or terminal spikes, or corymbs, and the fertile ones invested with an involucellum. The perianth is petaloid, inferior, tubular, 4-8 cleft, and deciduous. The stamens definite, perigynous, and biseriate, the outer row being often sterile. The anthers are 2-celled, extrorse, and burst lengthwise. The germen is free and 1-celled, and the ovule solitary and pendulous, the style single or absent, and the stigma peltate. The fruit is a fibrous drupe, with a solitary pendulous exalbuminous seed. The embryo is inverted, shrivelled, slightly lobed, and oily.

(1685.) Hence the Hernandiaceæ, differentially considered, are exalbuminous Laurinæ, with involucellate flowers, an inferior tubular, deciduous calyx, a solitary pendulous seed, and lobed cotyledons.

(1686.) The *Hernandiaceæ* are found both in the Old and New Worlds, being natives of the Antilles, of the Indian Archipelago, and of Guiana. The several species of *Hernandia* are mildly cathartic, and emulsions made from their seeds, as well as infusions of their leaves and bark, are used in Cayenne and in Java as purgative medicines. The juice of the leaves of *Hernandia sonora* is found to be an advantageous and effectual depilatory, as it destroys the hair wherever it is

applied, and this without pain. Descourtils says that, in the Antilles, the natives prepare an excellent liquor from the fragrant covering of the fruit. *H. sonora* has received its specific name from the noise made by the wind whistling through its persistent involucels. The generic name commemorates Hernandez, sent to Mexico by Philip II. of Spain, and is said to have been imposed on these plants, which have large leaves and little flowers, in allusion to the great opportunities afforded to the naturalist, and the small returns he made to science.

(1687.) THYMELÆACEÆ. Whether the Thymelæa of the ancients was, as some botanists assert, the Daphne Gnidium, or indeed any special plant, is a subject merely of conjecture. The derivation of the word, either from θυμα, a sweet scent or sacrifice, or θυμέλη, an altar, rather favors the idea that it was a

A

A. *Daphne Mezereum.*

(*a*) Branch in flower without leaves.

(*b*) Branch with leaves and fruit.

(*c*) The pistil (the inferior free perianth [*d*] being removed), shewing by a longitudinal section the solitary pendent ovule, single style, and stigma.

(*d*) Perianth open, to shew the free perigynous stamens.

(*e*) Section of the fruit, to shew the solitary seed.

(*f*) Transverse section of the seed.

(*g*) The embryo.

common name for fragrant woods, used as fuel in burnt offerings; and it is now applied as a collective term to a variety of shrubby plants, more or less shewy and ornamental, which, with two or three of the following types, are of little other economical importance than as fire-wood, and some of them are still employed in India, on account of their sweet smell, in religious services.

(1688.) The *Thymelæaceæ* are shrubs or small trees, very rarely herbaceous plants, with non-articulated branches, sometimes spiny, and the bark tenacious. The leaves are alternate (rarely opposite), simple, entire, and exstipulate.

The flowers are monoclinious (rarely diœcious), regular, and for the most part collected into axillary or terminal spikes, or fascicles, though sometimes solitary.

The perianth is single, tubular, coloured, at least internally, with a cleft limb, and the lobes imbricate in æstivation, stamina definite and perigynous, with 2-celled anthers dehiscing lengthwise, either laterally or centrally. Occasionally

abortive stamens form petaloid scales in the faux of the perianth. The germen is free, simple, 1-celled, and 1-seeded.

The fruit is indehiscent, either utricular or drupaceous, the seed solitary and exalbuminous, or with the albumen very scanty. The embryo straight, radicle short, and cotyledons entire.

(1689.) Hence, differentially considered, the Thymelæaceæ are exalbuminous or subalbuminous Laurinæ, with exarillate seeds, free 1-celled, 1-seeded ovaries, and inferior imbricate perianthia.

(1690.) The genera associated to form this group are distributable into two subtypes, the *Thymelidæ* and *Elæagnidæ*.

(1691.) The *Thymelidæ* differ from the *Elæagnidæ* in having smooth leaves, the perianth coloured within and without, and not covering the fruit: the ovules pendulous, and the embryo inverted.

(1692.) The *Elæagnidæ* have scaly leaves, the perianth scaly without, and persistent, covering the fruit when ripe; and the ovules and the embryo both erect.

(1693.) *Thymelidæ.* The spurge laurel and mezereon (*Daphne Laureola* and *Mezereum*), the lace-bark (*Lagetta*), and the leather-wood (*Dirca*), are the chief plants included in this subtype. They are all, with their allies, remarkable for their acrid, or rather caustic juices, so that their leaves and bark act as rubefaciants, and even as vesicatories. An ointment made from the spurge-laurel is by many persons preferred to savin for promoting the discharge from issues and setons, and to keep open blisters. The decoction of Mezereon is esteemed as an alterative, and with sarsaparilla it enters into the composition of the Lisbon, and other diet drinks. The tenacious barks of several genera have been made into cordage. From the liber of Daphne Bholua, a very soft kind of paper is manufactured in Nipal. The inner bark of the Lagetta lintearia is the vegetable-lace or Jamaica lace-bark; it consists of several layers, which may be separated and extended so as to form full ruffles, or may be pulled out into a silky web three or four feet wide, and of considerable length. Of this curious fabric our Charles II. had a cravat, frill, and ruffles, presented to him by the Governor of Jamaica.

(1694.) Passerina tinctoria affords a yellow dye, and is used as well as Daphne Tarton-raira, and D. Gnidium, in Languedoc and other parts of the south of Europe, to dye wool. The berries of this latter plant are the cocca Gnidia or grana Gnidia of medicine. They are cathartic, and according to Dioscorides about twenty serve for a dose for a man; but, notwithstanding their activity in the human *primæ viæ*, they are fed on by birds with impunity, partridges especially are fond of them, and their flesh is in nowise affected by them as food.

The berries of D. Mezereon have an acrid pungent flavour, and are called wild-pepper in Siberia. Lepechin states that the Russian ladies use these berries, and also the sap of the plant, to rub their cheeks with, in order to give them a roseate hue, from the slight inflammation thus produced; and Falk affirms that he has seen the Tartar women do the same. Pallas and Villars add, that the berries are taken both in Siberia and in Dauphiny as cathartics, thirty being a dose, and that they are also given to infants as a remedy for hooping-cough. They are, however, dangerous if administered without much care, for even eight or ten have produced very serious effects. Linneus records a case in which death ensued from hæmoptysis, after a dose of a dozen Mezereon berries, and he likewise tells us that they are employed in Sweden to poison wolves and foxes. The leaves and berries

of Daphne *Thymelæa* and *Tarton-raira* are used, the former in Spain and the latter in Greece, for the same purposes as those of the *Mezereon* and *Gnidium*. *Daphne Pontica* is one of the plants which imparts its deleterious qualities to honey collected from its flowers; and is, with the *Rhododendron Ponticum*, believed to have been the cause of the fearful sickness that attacked the soldiers of Xenophon during the celebrated retreat of the ten thousand.

(1695.) Elæagnidæ. The oleaster or wild-olive (*Elæagnus*), with the sea-buckthorn (*Hippophäe*), form this small subtype, to which have been added two other genera, discovered since its segregation, viz. *Shepherdia* and *Conuleum*. These plants are destitute of the acrid properties of the *Thymelidæ*, and several of them afford eatable fruits. The Zingeyd of Persia is the fruit of *E. orientalis*, and in Nipal those of *E. arborea* and *conferta* are eaten by the natives. The acid berries of Hippophäe Rhamnoides are made into sauce, and sometimes also eaten alone, both in this country and in France. They are a favorite food with the Tartars, and the fishermen in the Gulf of Bothnia eat them with their fish. They are entirely harmless, although in Dauphiny and Spain they are considered deleterious: and Rousseau mentions that a lawyer, near Grenoble, cautioned him against them, as poisons, and was astonished that death did not ensue when he saw the naturalist eat so plentifully. Every part of the plant abounds in colouring matter, which is used as a yellow dye.

(1696.) Proteaceæ. *Protea*, so named on account of the variable forms of foliage prevailing among the numerous species, is the normal genus of this type, which is intermediate between the Thymelæaceæ and Santalaceæ, having like the former the germen free, and agreeing with the latter in the valvate æstivation of the perianth.

This type includes genera commemorative of several celebrated botanists, as Banksia, Lambertia, Grevillea, Persoonia, Dryandra, Hakea, Nivenia, Serruria, &c. But, although handsome ornamental garden plants, they seem scarcely worthy, from the little use they are of, to have been dedicated to such a constellation of great men, and given as representatives or memorials of their sterling talents.

(1697.) The Proteaceæ are all exotic trees and shrubs, growing abundantly at the Cape of Good Hope and in New Holland. Their branches are exarticulate, and the young shoots for the most part arranged in umbels. The leaves are exstipulate and alternate, opposite or whorled; persistent, simple, usually undivided, but sometimes toothed, cleft, and occasionally compound. In texture they are peculiarly hard and dry.

The flowers are monoclinious (rarely diclinious by abortion), the inflorescence variable, being sometimes spiciform, sometimes the flowers are disposed in loose panicles or corymbs, and at others collected into congested heads, which, when invested with the dry persistent bracteæ, resemble cones.

The perianth is 4-leaved, the sepals being distinct or cohering into a tube with a 4-cleft limb. The sepals are subcoriaceous, coloured, pubescent externally, and valvate in æstivation, (one genus alone, *Franklandia*, having them induplicate.) The stamina are definite (4, or by abortion less), opposite the lobes of the calyx, and generally exserted with very short filaments from just below the edges of the sepals. The anthers are adnate, 2-celled, linear, and dehisce longitudinally. The pollen is normally triangular, sometimes elliptic or

lunate, rarely spherical. Occasionally there are found 4 hypogynous scales or glands, or barren stamens, alternating with the lobes of the calyx and prefiguring a corolla. The germen is free, often stipulate, formed of a single carpel, and the style simple and terminal, and the ovules 1-2, or many.

The fruit is variable, either dry or succulent, and either dehiscent or indehiscent, 1-2 or more seeded. The seeds exalbuminous, often winged, and furnished with a chalaza. The embryo straight and white, with 2 or more cotyledons, the plumula scarcely visible, and the radicle inferior and short.

(1698.) Hence, selecting the chief differential and associating characters, the Proteaceæ may be said to be exalbuminous Laurinæ, with an inferior 4-lobed valvate perianth, opposite definite stamens, definite erect ovules, and inferior radicles.

(1699.) The Proteaceæ are innoxious plants, devoid of any active properties, and applied to very few economical purposes. The bark of *Protea grandiflora* is, however, said to be slightly astringent, and to be employed as a remedy in diarrhœa at the Cape. *P. mellifera* secretes, in tolerable abundance, a honey-like or syrupy fluid, which is collected and taken as a demulcent for coughs; and Thunberg reports that the bark of *P. speciosa* is used for tanning leather. *Guevina avellana*, a Chilian species, according to Molina, bears seeds that resemble nuts, and are eatable; and those of Embothrium tinctorium yield a powder that forms a good pink dye. Some few of the arboreous Proteaceæ, such as several species of Rhopala, afford tolerable timber, but in general, beyond ornamental purposes, these plants are of little service to man except as fire-wood, for which they are used largely at the Cape of Good Hope.

(1700.) Penæaceæ. *Penæa*, a genus, the affinities of which have been long considered questionable, is now made typical of a small group, that I cannot but refer, with Lindley, to the neighbourhood of Proteaceæ, notwithstanding it is usually placed near Epacridaceæ.

(1701.) The Penæaceæ are evergreen shrubs, natives of the Cape of Good Hope, with opposite or imbricate exstipulate leaves, inflorescence terminal or axillary, flowers monoclinious, the perianth usually of a red hue, inferior, salver-shaped, with a 4-lobed or quadripartite limb, either valvate or imbricate in æstivation, and with two or more bracteæ at its base. The stamens are definite (4-8), exserted from the lower part of the tube of the calyx, the anthers 2-celled and introrse. The germen is superior, 4-celled, style simple, stigmata 4; ovules 1 or more, erect, or suspended, but with the foramen always next the placenta. The fruit is capsular and 4-celled, the seeds, like the ovules, either ascending or pendulous, the testa brittle, and the nucleus a solid mass with no distinction of albumen or embryo, the radicular end (?) next the hilum, which is fungous.

(1702.) Hence, differentially considered, the *Penæaceæ* are Laurinæ, with superior 4-celled ovaries, definite ovules, and homogeneous embryo.

(1703.) Small as is this type, indications may be observed which will probably in future lead to its subdivision, for in *Penæa* the æstivation of the calyx is valvate; the flowers are tetrandrous, the connectivum fleshy, and the ovules pendulous; while in *Geissoloma*, the æstivation is imbricate, the stamens 8, the connectivum not fleshy, and the ovules erect.

These variations in the genera shew the type to be transitional, the imbricate æstivation and fleshy connectivum, and erect ovules of Penæa, associating it with

the *Proteaceæ*, while, by its valvate æstivation, obliterated connectivum, and pendulous ovule, Geissoloma is allied to the *Santalaceæ*.

(1704.) That peculiar resinoid gum soluble both in alcohol and water, and called sarcocol, is the produce of the Penæa sarcocolla and other species, natives of Ethiopia. It is an exudation found chiefly on the perianths of the flowers, and as collected for importation it is in small grains like sand, of a yellow or reddish colour, and very fragile. It is inodorous, has a sweetish taste when first put into the mouth, but when dissolved it becomes hot and acrid, and causes an abundant flow of saliva. It has long been known, and was formerly administered, as a cathartic; but Serapion condemned its internal use, as he believed its causticity to ulcerate the intestines. By the Greeks it was employed to stimulate ulcers and consolidate wounds, whence its name. It is now, however, but little used. Its active properties depend upon a principle discovered by Thompson, and named Sarcocolline. Dr. T. considers sarcocol to be closely allied to the saccharine matter of liquorice. It has also been said to be present in the pericarp of *Acacia farnesiana*. (*Ricord.*)

(1705.) SANTALACEÆ. The sandal-wood (*Santalum*), the tupelo (*Nyssa*), and the Poet's cassia (*Osyris*), which, with a few other genera, are associated to form this group, are distributable into three subtypes, that from the above named genera are called *Osyridæ*, *Nyssidæ*, and *Santalidæ*.

B. *Santalum album*. Branch bearing leaves, flowers, and fruit.

(*a*) Flower with the calyx open, to shew the perigynous stamens and inferior germen, simple style and lobed stigma.

(*b*) Stamen detached with its feather-like appendage.

(*c*) The ripe fruit.

(*d*) Longitudinal section of the fruit to shew the adherent perianth and solitary inverted seed.

(1706.) The *Santalaceæ*, collectively considered, are trees, shrubs, or herbaceous plants, with round or irregularly angled branches, alternate, nearly opposite leaves, sometimes small and resembling stipulæ, but which organs are absent.

The flowers are small, united, (or by abortion polygamous and diœcious,) and collected into spikes, racemes, or sertula, seldom solitary. The perianth is

single, superior, coloured internally, and 3-4-5 cleft, with a valvate æstivation of the lobes. The stamina are definite, opposite the sepals, which they equal or double in number, and from the base of which they are exserted. The anthers are terminal and 2-celled, (rarely 4-celled.) The ovarium is generally inferior, 1-celled, with 1-2-4 pendulous ovules, springing from the top of a free central placenta. This style is single, and the stigma often lobed. The fruit is indehiscent, hard and dry, or sometimes slightly succulent, and by abortion monospermous. The seed is exarillate and pendulous, the albumen fleshy, and of the same shape as the seed, the embryo axile, and the radicle superior.

(1707.) Hence, with reference to the chief associating and differential characters alone, the *Santalaceæ* are albuminous exarillate Laurinæ, with a valvate æstivation of the calyx, and in general, inferior 1-celled ovaries and solitary seeds.

(1708.) The three subtypes *Osyrida*, *Nyssidæ*, and *Santalidæ*, exhibit a most interesting series of modifications occurring in plants closely allied to each other, and yet deviating from the rule of their association to establish connexions with surrounding groups. Thus

(1709.) In the *Osyridæ* the ovarium is free and superior, the stamens 3 (?), and the perianth 3-cleft.

(1710.) In the *Nyssidæ* the ovarium is inferior and the calyx adnate, the 1-celled ovary is 1-ovuled, and the flowers are polygamous, the embryo is not cylindrical, and the cotyledons are large and foliaceous.

(1711.) While in the *Santalidæ* the inferior 1-celled ovary is 3-ovuled, the fruit becoming 1-seeded by abortion, and the embryo is round.

(1712.) *Osyridæ*. The Osyris of Pliny, according to the accounts transmitted to us, was a marvellous vegetable, endowed with the property of curing every disease. The Poet's cassia, our modern *Osyris*, cannot certainly be the plant which he describes, for, excepting a slight astringency, it possesses no sensible properties as a medicine, and is now only used for making besoms, for which its long slender supple branches fit it. *O. Japonica* is occasionally eaten as a salad. Exocarpus has received its name from the enlarged receptacles on which the fruit is placed, giving it the appearance of being a seed outside of its seed-vessel: a new species of Exocarpus, discovered by Mr. Bauer, and mentioned by Dr. Brown, in the Appendix to 'Flinder's Voyage,' is remarkable for bearing its flowers on the margins of dilated foliaceous branches, concerning which it would be difficult otherwise to determine whether they were boughs or leaves.

(1713.) *Nyssidæ*. The *Ogeehee Lime* is the fruit of Nyssa candicans, and the fruits of other species are preserved by the French colonists on the Mississippi, and used instead of olives. The *Nyssæ* are trees of great singularity and beauty, especially *N. denticulata*, which rises to the height of 80 or 100 feet. Its wood is white, soft, compact, and light, and therefore valued by the carver and turner.

(1714.) *Santalidæ*. The *Thesia* are inodorous, slightly astringent plants, of little beauty. The *Thescion* of the ancients was said to have been so named on account of its having been presented to Ariadne by Theseus, but our plant cannot be the one to which Athenæus and Timachides refer, as its obscure flowers, devoid of elegance, would scarcely have caused it to be selected for such a purpose. The *Santala* or sandal-woods, especially the *Santalum album*, or true sandal,

are peculiarly fragrant. Hence their timber is much valued. When young it forms the white sandal, and when old, the yellow sandal wood of commerce; and, so great is the demand for it, that the trees are seldom allowed to grow to more than a foot in diameter. It is made into musical instruments, cabinets, and curious boxes, for which it is valued, as no insect can exist, nor iron rust (it is said) within its influence. The oil used by the Brahmins in their religious ceremonies is scented with sandal, and with the dust of the wood they form the pigment which they use in giving the frontal mark to the god *Vishnu*. Sandal-wood is extensively employed at the funerals of the Hindoos, and the nearer it is got from the root, and the deeper the colour, the greater is the fragrance. It is an article of export from the Malabar coast to Bengal and China, but is seldom brought to Europe. The native doctors, in India, consider it to be possessed of sedative and cooling properties, and occasionally use it as a medicine.

(1715.) Terminaliaceæ. *Terminalia, Bucida,* and the other genera included in this type, were formerly associated with the *Santalaceæ* and *Elæagnidæ* of the *Thymelæaceæ,* under the common name Eleagneæ. But on the reformation of this Jussieuan group, by its author and succeeding botanists, the *Terminaliaceæ* were separated from the *Elæagnidæ* and *Santalaceæ,* and admitted as a distinct and separate type. Its connexions, however, are so numerous and so distant, that its systematic arrangement is a matter of difficulty; for so close are its affinities with *Combretum* and the other *Combretaceæ,* that the two groups have often been conjoined, and then the dichlamydeous flowers of the latter would lead to their joint location near the *Onagrariaceæ,* amongst the polypetalous Rosales. It seems therefore most advisable to leave the Terminaliaceæ, which are apetalous, in the neighbourhood of the Santalaceæ and Elæagnidæ, with which they "agree in many important particulars," and only to transfer the polypetalous Combretaceæ to the Onagrinæ of the Rosales: as this may perhaps fulfil the double indication to which De Candolle adverts, when he says they may be placed indifferently in the neighbourhood of the distant groups just mentioned, to one of which they are related by the apetalous, and to the other by the polypetalous genera.

(1716.) The *Terminaliaceæ* are tropical shrubs or trees, with alternate (rarely opposite), exstipulate, entire, coriaceous leaves. The inflorescence is in axillary or terminal spikes or racemes, the flowers are regular, united (rarely polygamous by abortion), the calyx adnate to the germen, the limb 5-lobed, valvate in æstivation, and deciduous. Petals none, stamens definite, arising from the orifice of the tube of the perianth, and in general double the number of its lobes: filaments free, anthers terminal, 2-celled, with opposite locules dehiscing by a longitudinal chink, germen inferior and 1-celled, ovules definite (2-4-5) and pendulous from the upper part of the ovary, but not attached to any central column. The style is single, and the stigma undivided.

The fruit is indehiscent, either dry or succulent, often ribbed or winged, 1-celled, and in general, by abortion, monospermous. The seed is large, pendulous, and exalbuminous, the embryo straight and cylindrical, the radicle turned towards the hilum, and the cotyledons spirally folded.

(1717.) Hence, differentially considered, the Terminaliaceæ are exalbuminous Laurinæ, with a superior calyx, the limb valvate in æstivation, and deciduous; an inferior 1-celled ovarium without any central column, definite pendulous ovules, and spiral cotyledons.

(1718.) The Terminaliaceæ are astringent plants. Terminalia vernix abounds with a resinous juice that is used in the Moluccas and in China as a varnish, and T. catappa affords a black pigment with which the Indians dye their cloth, and from which Indian pink is made. The fruits of Terminalia bellerica and T. chebula are very astringent, more especially the latter, which, as well as the galls with which it abounds, are used for tanning leather. The root of T. latifolia is administered medicinally in Jamaica in cases of diarrhœa, as is also the bark of T. alata. *Bucida buceras,* the black olive or French oak of the West Indies, yields excellent timber, and its bark is highly valued by the tanners, as is likewise that of *Conocarpus racemosa,* one of the plants called mangroves in the West Indies.

HIPPURINÆ.

(1719.) The plants included in this small section have, like the Terminaliaceæ, been in general referred to the polypetalous series, and associated like them with the *Onagrinæ.* Dr. Brown and others have, however, noticed the incongruity of this arrangement, and occasionally one or more of the types now brought together in this section have been transferred to the apetalous division.

(1720.) The Hippurinæ, collectively considered, are monochlamydeous *Rosares, i. e.* herbaceous or suffruticose *Querneales,* with or without albumen, and the cotyledons variable; being either very small, unequal, or numerous.

(1721.) Three types are included in this section, to which the normal genera *Hippuris, Trapa,* and *Ceratophyllum,* have given their names respectively.

(1722.) Hippuridaceæ. (*Halorageæ R. Br.*) *Haloragis* (the sea-grape), *Hippuris* (the mare's-tail), and *Callitriche* (the water-starwort), which, together, form this type, are herbaceous aquatic plants, with whorled, opposite (or rarely alternate) leaves, without stipulæ.

The flowers are axillary or disposed in terminal spikes, united or separated, apetalous, and often with two fistular coloured bracteæ. The tube of the calyx is adherent to the ovary, and the limb obscure. The petals none, or very minute. The stamens 1-2, or more, perigynous. The anthers 1-2-celled, dehiscing longitudinally, and the connectivum obsolete. The germen is inferior, 1-4-celled, each cell 1-4-seeded. The fruit is dry and indehiscent, 1-4-celled, 1-4-seeded, the seeds pendulous, the albumen fleshy, the embryo straight and axile, the radicle superior and long, and the cotyledons two and small.

(1723.) Hence, differentially considered, the *Hippuridaceæ* are albuminous *Hippurinæ,* with inferior ovaries, and two equal minute cotyledons.

(1724.) *Haloragis, Calitriche, Hippuris,* and their allies, though agreeing in the above general characters, differ in so many minor particulars that they are distributed into three subtypes, the *Haloragidæ, Callitrichidæ,* and *Hippuridæ.*

(1725.) In the *Haloragidæ,* the limb of the calyx is evidently parted. The petals sometimes developed. The stamens always more than two (3-8.)

(1726.) In the *Hippuridæ* the limb of the calyx is small and entire. The petals always absent. The flowers are monandrous, the anthers bilocular, and the fruit 1-celled and 1-seeded.

Hippuris vulgaris.

c. Cuttings of the upper and lower parts of a plant, to shew the verticillate leaves from the axillæ, of which the flowers spring.

(*a*) A flower separated, to shew the inferior germen, the obsolete limb of the calyx, and the single stamen and pistil.

(*b*) Section of ditto, to shew the pendent ovule.

(*c*) The ripe fruit.

(*d*) Section of ditto, to shew the solitary pendulous seed, with the embryo straight in the axis of a fleshy albumen, and the small cotyledons.

(*e*) Transverse section.

(*f*) A seed.

(1727.) In the *Callitrichidæ* the flowers are invested by two petaloid bracteæ, the limb of the calyx is abortive, the stamens are sometimes (though rarely) two in number, the anthers unilocular, and the fruit 4-celled. Each cell being monospermous, and the seeds peltate.

(1728.) These plants do not possess any notable properties; they are innoxious, and perhaps slightly nutritious, as they are fed on by wild ducks; and, growing abundantly in damp places, are said, by the large quantities of carbonic acid and carburetted hydrogen they absorb, to tend much towards purifying the air of marshes, and rendering that in water respirable by fish and other aquatic animals.

(1729.) Trapaceæ. The water-caltrops (*Trapa*), is typical of this group, sometimes called *Hydrocaryes* or water-nuts, in reference to the large eatable seeds which all the species produce. The word *Trapa* is an abridgment of *Calcitrapa*, the Latin name of an instrument of war, designed to impede the progress of cavalry, and to which the fruit of some of the *Trapæ*, furnished with strong spines, bears a fanciful resemblance.

(1730.) The *Trapaceæ* are floating herbaceous plants, with the lower leaves capillary and opposite, the upper ones entire and alternate, and the petioles tumid in the middle. The inflorescence is axillary, the flowers small, the calyx superior and 4-parted, the petals developed equal in number to the lobes of the calyx, and exserted from its faux. The stamens 4, perigynous, and arising alternately with the petals. The ovary is 2-celled, and the ovule solitary and pendulous; the style is filiform, thickened at the base, and the stigma capitate. The fruit is dry, hard, and indehiscent, 1-celled, 1-seeded, and crowned by the indurated segments

of the calyx. The seed is large, pendent, solitary, and exalbuminous: and the embryo straight, with two very unequal cotyledons.

B

Trapa natans.

B. Entire plant, shewing the lower multifid and upper simple leaves.

(*a*) Flower, shewing the cleft calyx.

(*b*) Ditto opened, to shew the petals, stamens, and pistil, with the pendent ovules in the 2-celled ovary.

(*c*) The fruit with its spines.

(*d*) Section of the same, to shew the solitary, pendulous, exalbuminous seed.

(*e*) A seed germinating, shewing the large stipitated cotyledon, and the small one near the radicle, almost abortive.

(*f*) The large cotyledon separated.

(1731.) Hence, differentially considered, the *Trapaceæ* are exalbuminous Rosares, with two very unequal cotyledons.

(1732.) From the exceeding disparity of the seed-lobes, the *Trapæ* were once considered to be monocotyledons, and associated with the *Hydrocharinæ*, and it is probable that they, as well as some other plants, already and hereafter to be mentioned, are intermediate stages between the two great schemes of structure evidenced in the di- and mono-cotyledons. *Trapa natans* is an European plant, abounding in Switzerland and the South of France. Some of the canals at Versailles are covered with it, and the fruit is collected and eaten as chesnuts. At Venice they are sold under the name of Jesuit's-nuts; at Vercelli they are called galarin, and are much eaten by the common people and children. Pliny tells us that the Thracians used to make them into bread. Trapa bicornis, which is common in China and Japan, is often brought to this country on account of its singular two-horned seeds, resembling the head of a bull. Thunberg says that in Japan these farinaceous nuts are put into broth or made into porridge. T. bispinosa, quadrispinosa, &c. are eaten in the countries where they grow; the former is much esteemed by the Hindoos.

(1733.) Ceratophyllaceæ. *Ceratophyllum*, the horn-wort, of which but seven species have been discovered, stands alone in this type, the affinities of which have been much disputed, but which seems only with violence to be removed far from *Trapa*, *Hippuris*, and *Myriophyllum*.

(1734.) The *Ceratophyllaceæ* are much-branched floating herbs, with whorled, multifid, cellular, exstipulate leaves, the segments being filiform and subserrate.

The flowers are axillary, monœcious, and monochlamydeous. The perianth is inferior and multipartite, with equal segments. The stamens (12-20) are without filaments, and congested in the centre of the flowers, the anthers 2-celled, and bi-tricuspidate at their summits. The germen is free, ovate, and 1-celled. The style incurved and filiform, and the stigma simple.

The fruit is a 1-celled, 1-seeded nut, indehiscent, and terminated by the hardened style; the seed is solitary, pendulous, and exalbuminous, the embryo straight, the radicle superior, the cotyledons four and whorled, and many-leaved.

(1735.) Hence, differentially considered, the *Ceratophyllaceæ* are herbaceous Querneales, with superior ovaries, exalbuminous seeds, polycotyledonous embryo, and compound plumule.

(1736.) The humble but useful office of these plants would seem to be the purification of water, and the elaboration of respirable air.

PIPERINÆ.

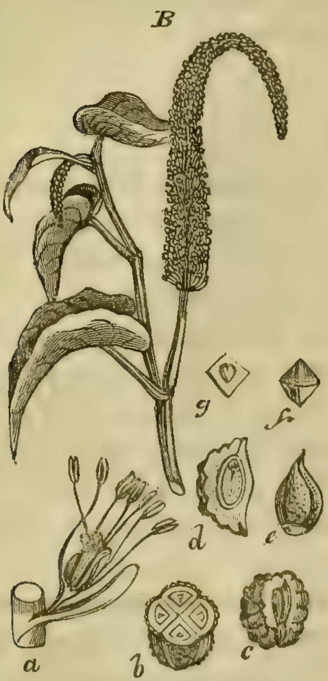
(1737.) *Chloranthus*, *Piper*, and *Saururus*, are the normal genera of the three types *Chloranthaceæ*, *Piperaceæ*, and *Saururaceæ*, associated to form this section. The genera included in these groups, although naturally allied, blend in so remarkable a manner the structural peculiarities which distinguish two primary divisions of the vegetable kingdom, that they have been referred successively by botanists of equal authority to both, and at others almost denied accession to either. These discrepancies in arrangement are chiefly attributable to the unwise attempts that have been made to render terms synonymes which have not strictly similar meanings. Of this an instance has already been adverted to, in the Outlines of *Filicologia* [§ 833], and just as objections were made to admitting Ferns into the tubivascular region, because they are acotyledons and flowerless, notwithstanding the demonstration of tubular vessels in their endogenous stems, so likewise the *Piperinæ* and other Rosares have been retained amongst the monocotyledons, because their embryos are 1-lobed, or at least that they are doubtful dicotyledons, although there is no doubt of their exogenous structure; their stems being stratified and traversed by medullary rays.

(1738.) It is strange that these double affinities, which connect distant and dissimilar groups of plants, should ever have been esteemed difficulties in the way of natural arrangement; but it is to be hoped that the time is come when such beautiful gradations, which lead step by step, and render the passage easy from one region to another, will no longer be regarded as stumbling-

blocks in the path of science, and that the wisdom of nature will henceforward cease to be foolishness to man.

(1739.) The PIPERINÆ are angiospermous, achlamydeous exogenæ, or *Querneales,* with a spadiciform inflorescence, and albuminous seeds; the (1-lobed) embryo being inclosed in a sac (the persistent vitellus), or lodged in a hollow of the albumen.

(1740.) SAURURACEÆ. *Saururus, Aponogeton,* and the other genera associated to form this type, are aquatic or marshy herbs, or herbaceous plants, with perennial rhizomata, knotted stems, and simple, entire, alternate leaves, with vaginal stipulæ.



Saururus cernuus.

B. Branch with leaves and terminal spikes of flowers.

(*a*) Section of the spike, with one achlamydeous bracteate flower.

(*b*) Transverse section of the 4-celled ovary.

(*c*) One of the carpels of the ripe fruit.

(*d*) Section of ditto, to shew the embryo in its vitellus on the apex of the large albumen.

(*e*) A seed detached.

(*f*) The vitellus or sac containing the embryo.

(*g*) Section of ditto, to shew the embryo within it.

The flowers are united, achlamydeous, each being invested with a scale, and springing from terminal spadices. The stamens are definite (3-6), hypogynous, free, and persistent, the filaments slender, the anthers erect and 2-celled, with either an introrse or lateral longitudinal dehiscence; the connectivum is thick and continuous with the filament. The germen consists of 2-4 carpella, more or less connate, sometimes forming a 3-4-celled ovary with definite ovula ascending from the edge of the projecting semidissepiments. The styles are short and the stigmas simple. The fruit consists of one or more indehiscent nuts, or a 3-4-celled capsule opening at its apex. The seeds are few and ascending, the albumen large and mealy, remote from the hilum, and with a superficial depression at its apex; the embryo is 1-lobed (?), very minute, and enclosed within its persistent vitellus.

(1741.) Hence, differentially considered, the *Saururaceæ* are Vitellose Piperinæ, with alternate stipulate leaves, a 2-4-celled ovary, and ascending ovules.

(1742.) The *Saururaceæ* appear to be extratropical representatives of the peppers; but, growing in less fervid climes, they are devoid of the hot and pungent properties of those celebrated peptic plants.

(1743.) PIPERACEÆ. *Piper* and *Peperomia*, included in this type, are herbaceous or shrubby plants, with knotted stems, and opposite or verticillate leaves, (by abortion becoming alternate.) The petioles are sheathing at the base, but without stipules or intrapetiolar vaginæ; and the lamina is simple, entire, and often fleshy.

The inflorescence is spadiciform, the flowers bracteate, achlamydeous, and united, the stamina in general definite (2-3, rarely more), the anthers erect, 1-2-celled, and opening lengthwise, and the pollen in smooth grains. The germen is superior, 1-celled, and the ovules solitary and erect. The stigma 1 or more, sessile, and slightly hispid. The fruit is indehiscent, with a subcarneous mesocarp and a thin membranous endocarp. The seed subglobose and erect, the albumen cartilaginous, and the small monocotyledonous embryo is remote from the hilum, and enclosed within its persistent vitellus.

(1744.) Hence, differentially considered, the *Piperaceæ* are angiospermous Exogenæ, with a (1-lobed) vitellose embryo, opposite exstipulate leaves, a 1-celled ovarium, and erect solitary seeds.

(1745.) The English word *pepper* is the immediate offspring of the Latin *piper*, as that is of the Greek πεπερι or πιπερι; and this name, again, comes from the East, as does the substance to which it belongs: in Bengalee it is called *pippul*.

Several hundred species of pepper now are known, and these have been formed into two genera, called *Piper* and *Peperomia*. They are all tropical plants, abounding in the hottest regions, and exclusively found in the equinoctial zone. They are warm and even acrid spices, and the pungent aromatic principle so familiar in culinary pepper, is common to the whole group, and pervades the entire plants, being, however, more concentrated in some parts than in others, as in the fruit, and variously modified in the various species.

(1746.) The black, the long, the cubeb, and the betel peppers, are the best known and most valuable species, although many of the others, in case of necessity, might replace the ordinary spice.

(1747.) *Piper nigrum*, the tieo-bo of the Cochin-chinese and the Melago-codi of the Hortus Malabaricus, is cultivated in various parts of the East, as in Java, Sumatra, Borneo, and the Phillippine Isles, and grows in the greatest abundance in the province of Malabar, constituting one of the principal articles of export. According to Milburn, the pepper countries extend from about 96° to 115° east longitude, and from 5° to 12° north latitude, beyond which limits few plants are found, and their cultivation ceases. The annual crop of each pepper-plant or vine varies from half a pound to a pound, and the quantity collected for human consumption is immense. The yearly produce of Sumatra alone is estimated at 168,000 peculs. The islands at the mouths of the Straits of Molucca and Singapore, the coasts of the Malay peninsula, and the countries about Patmi and Calantan, afford from 40 to 55,000 peculs. From the eastern coasts of the Gulph of Siam there are annually exported not less than 60,000 peculs, 40,000 of which are claimed by the authorities at Siam as a tribute. Borneo yields about 20,000 peculs. So that the average aggregate production of pepper may be esti-

mated at about 338,000 peculs or 45,066,666 lbs. Of this, taking the amounts of the last ten years, from 4 or 5 to upwards of 13,000,000 lbs. have been annually imported into Britain, and, notwithstanding the oppressive duty to which this article is subject, nearly 2,000,000 lbs. are retained for home consumption. As Mr. M'Culloch observes, "pepper is one of the most grossly over-taxed articles in the British tariff. Until 1823 the duty was 2*s*. 6*d*. per pound, a duty so exorbitant that one would be inclined to think it had been imposed in order to put a total stop to the use of the spice. In 1823 the duty on pepper, from a British possession, was reduced to 1*s*. per pound, but even this duty, if compared with the price of the article (only 2¾*d*.—4*d*. per pound), is quite enormous; amounting to no less than from 420 to 500 per cent." The excessive duty is to be regretted, as it limits the consumption of a wholesome condiment. Since the reduction of price, in 1823, the consumption has increased more than one fourth, and, were the price less, it would probably be trebled.

(1748.) Besides its use as a stimulating condiment, and most useful digestive spice, pepper possesses febrifuge properties, and has been administered successfully in cases of ague. Dioscorides mentions pepper as a valuable medicine in intermittent fevers; Celsus also repeats that it is useful in fevers not of a continued type; and modern practice has confirmed the old opinions. Gordini, Levissuer, Wolf, and others, speak highly in its favor; and Riedmiller reports that he has administered it with success in upwards of 500 cases.

Black pepper owes its stimulating powers to a principle called *piperin*, discovered by Œrstadt. This principle is a febrifuge, like the pepper from which it is procured; but, from the experience of Dr. Roberts, who tried it in five or six cases of ague, in St. Thomas's Hospital, it does not appear to be more efficacious than quinine, while it is much more expensive: the dose however is smaller, but this is a slight recommendation. The two sorts of common peppers, known as the black and white, are the produce of the same plant: the black is the fruit entire, the pericarp being allowed to dry on the seed; the best white consists of the ripe seeds which have fallen from the plant, and are picked up by poor people from under the vines. The largest quantity, however, is produced by steeping the black pepper in warm water, and rubbing off the pericarps: much of the pungency, however, is thus removed, but it becomes a more sightly condiment.

Long-pepper has nearly similar properties, and is applicable to similar purposes as the black, but it has no peculiar advantages, and is but little used. Ainslie says that the root of this plant is prescribed by the Hindoo doctors in cases of palsy and tetanus.

(1749.) The cubeb-pepper is pungent and stomachic, like the previous species, but it possesses a peculiar aroma, considered agreeable by some persons, but very nauseous by others. It is chiefly used as a medicine to restrain inordinate fluxes from various mucous membranes, over some of which it was at one time thought to exert a specific influence.

(1750.) *Piper anisatum*, found by Humboldt on the banks of the Orinoco, has a strong smell and taste of anise. *Piper methysticum* is the *Kava*, the root of which Cook and other voyagers tell us that the South Sea islanders chew, and then squeezing out the juice, offer the disgusting beverage to their guests to drink. In the Sandwich and the Society Isles, this liquor is drunk by the natives before they undertake any important business, and previous to their religious

sacrifices. It is reputed to be wholesome; but the Europeans have since taught them, instead of chewing, to macerate the bruised root in water, and to let the infusion ferment, by which means an inebriating liquor is produced.

The betel-pepper is chewed with the areca nut as tobacco is in Europe; and, from its intoxicating powers, as well as from its allaying the calls of hunger, it is one of the most common luxuries of the East, and indulged in by the lower ranks to a very injurious excess.

(1751.) CHLORANTHACEÆ. *Chloranthus*, *Ascarina*, and their allies, which are associated to form this type, are herbaceous plants or under-shrubs, with nodose branches and opposite simple leaves, the petioles of which are fleshy, and form at their base vaginal expansions, which are often connate. The inflorescence is spicate, the flowers united or separate, and achlamydeous, but the stamens definite, if more than one, connate, the filament short, and the anther 2-celled. When the flowers are triandrous the central stamen has a 2-celled anther, while those of the lateral ones are unilocular. The germen is 1-celled, the ovule solitary and pendulous, and the stigma sessile. The fruit is drupaceous and indehiscent; triangular, unilocular, and monospermous. The seed is pendulous and albuminous. The embryo is not covered by any vitellus, minute and inverted, the radicle being inferior, and consequently remote from the hilum. By those who consider the embryo dicotyledonous, the lobes are said to be divaricate.

(1752.) Hence, selecting the chief differential characters, the *Chloranthaceæ* are non-vitellose *piperinæ* with opposite leaves and sheathing petioles.

(1753.) The *Chloranthi* are aromatic plants, but on the whole of less pungency and fragrance than the peppers. *Chloranthus officinalis*, which has been used in medicine, loses the odour of its leaves by exsiccation, the roots alone retaining their camphor-like smell and aromatic bitter flavour. An infusion of the *C. inconspicuus* is esteemed, according to Horsfield, as a light stimulating tonic, and is prescribed in Java during convalescence from fever. Lindley says, these plants "are found to possess very nearly the properties of *Aristolochia serpentaria*, and in as high a degree," which is a peculiar coincidence, for the *Aristolochiæ* belong to the following section.

(1754.) The *Podostemaceæ* of the *Nayadinæ* [§ 1131], are by some systematic writers referred to the vicinage of the peppers, and they have very much the habit and appearance of *Saururus*, but whether the similitude of these two groups may be one of affinity, or of analogy alone, as yet is undecided, and the same may be said of *Aponogeton*, which greatly resembles some *Potamogetons*; and of the *Ceratophyllaceæ*, which, by their many cotyledons, approximate the coniferous Pineales.

ASARINÆ.

(1755.) Plants agreeing in certain general characters with the Asarabacca (*Asarum*), form the section ASARINÆ. These are very few in number, and are distributable into only two types, called, from *Aristolochia* and *Nepenthes*, their normal genera, the ARISTOLOCHIACEÆ and NEPENTHACEÆ.

(1756.) The ASARINÆ are monochlamydeous Querneales, with

monadelphous or epigynous stamens, many-celled ovaries, albuminous seeds, and included embryos.

The stem of *Nepenthes* is scarcely exogenous, although the cotyledons are two in number, and the embryo in *Aristolochiaceæ*, before germination, is undivided.

(1757.) Aristolochiaceæ. Aristolochia, Asarum, and their allies, are herbaceous plants or shrubs, with abortive or climbing stems, simple, alternate petiolate leaves, the base of the leaf-stalk subamplexicaul, the expansion pedatinerved, and the lower leaves occasionally abortive and squamaceous, resembling stipulæ.

The inflorescence is axillary, the flowers solitary or fasciculate, and united. The perianth is adnate to the germen, coloured, generally of a dull hue, and valvate in æstivation; occasionally ascidiform, with an epigynous trilobed-limb often very irregularly divided, and produced into a strap or lid. The stamina are definite (6-18), epigynous, and either free or attached to the style. The filaments are short, and the anthers 2-celled and adnate. The germen is inferior, formed of 3-6 connate carpels, 3-6-celled, and the ovules are many, attached to central trophosperms. The styles are connate, the stigmata radiating and equal in number to the cells of the ovarium.

The fruit is capsular or baccate, 3-6-celled, and the cells many-seeded. The seeds are albuminous, the embryo minute, included within the base of the fleshy albumen, near the hilum, and undivided before germination.

(1758.) Hence, selecting the chief differential and associating characters, the *Aristolochiaceæ* are epigynous *Asarinæ*, with simple leaves, a synsepalous perianth, the lobes of which are valvate in æstivation, and an undivided embryo before germination.

(1759.) The *Aristolochiaceæ* are distributable into two subtypes, the *Aristolochidæ* and *Asaridæ*.

(1760.) In the *Aristolochidæ*, the stamens are gynandrous.

(1761.) In the *Asaridæ*, the stamens, although epigynous, are free.

(1762.) *Aristolochidæ*. The *Aristolochiæ* were the celebrated birthworts of old time; and A. Clematitis is still, in our provinces, held sacred to Lucina. Most of the other species are, however, famed as serpentaries, and of their influence over venomous reptiles more wonderful tales are told than modern naturalists feel inclined to vouch for; still it must be confessed the opinion is most prevalent that the Egyptian snake-jugglers chew the roots of serpentary, and stupify the reptiles by introducing a little of the impregnated saliva into their mouths. *Aristolochia anguicida* is even said to have so strong and penetrating an odour, that serpents avoid the places in which it grows, and when a branch is carried by a traveller, they will flee before it. According to Jacquin, a few drops of its juice introduced in a serpent's mouth produces a kind of drunkenness, during which the reptile will allow itself to be handled with impunity, and that if given in larger quantities the intoxication ends in death. It is also added, that the sap applied to the wound, or a decoction of the plant taken internally, will infallibly cure the bites of venomous snakes. *Aristolochia trilobata*, which is another of the anti-ophidian species, is said to have a smell resembling that of cherries, and if taken in doses of from 6-20 grains, to be a sudden and powerful sudorific. The perianth of this plant bears some resemblance in shape to that of the leaves of Nepenthes [§ 1765]; indeed, the flowers of the different species are very variable

in form, and some of them so large that children, in play, use them for hats and bonnets.

The roots of *A. grandiflora* have a very powerful and nauseous odour, and M. Tussac says they kill animals who feed upon them, even hogs; and it is probable that our common *A. Clematitis* is deleterious likewise, if fed on in considerable quantities.

Aristolochia trilobata, shewing the 3-lobed leaves, inferior germen, synsepalous ascidiform perianth, with irregular lid-like limb.

A. bracteata is reputed to possess anthelmintic powers, and a decoction of the leaves to cure the itch. The leaves, when fresh, will produce free evacuations from the bowels of young children when bruised and applied as a poultice over the navel. (*Ainslie.*)

A. odoratissima, serpentaria, longa, rotunda, &c. are all in slightly varied degrees aromatic stimulating tonics, and appear to be useful medicines in the latter stages of low fever, and in many other ataxic disorders.

(1763.) *Asaridæ. Asarum* is whimsically said to be derived from the privative α and σειρα, a band or fillet, because, from its dull inconspicuous flowers, devoid of beauty, it is a plant unfit to be made into wreaths or garlands. Our English name, *Asarabacca,* is evidently formed by the union of the two Latin words *Asari bacca, q. d.* the berry of the Asarum, because the fruit was once esteemed in medicine. The root-stake or rhizoma is, however, by far the most active part, and that which alone is now used officinally.

Asarabacca is possessed of emetic, purgative and diuretic powers, and, from its common use in France by drunkards to produce vomiting, it has obtained in that country the name of *Cabaret.* The powder of Asarabacca is an excellent sternutory; it enters into the composition of medicinal snuff, and in cases of inveterate headach, as well as in certain chronic inflammations of the eyelids, its use has afforded very marked relief. It is said that the acrid principle of *Asarum* is similar to that found in the *Arum,* but it is not so entirely dissipated by heat, although its activity is lessened by desiccation.

(1764.) *A. canadense*, or wild-ginger, is esteemed as a spice in Canada, where, according to Tournefort, the old French colonists used it to season their meats; its taste is said to combine those of ginger and serpentary. It has also been employed medicinally in the treatment of fever and of tetanus..

(1765.) Nepenthaceæ. The Nepenthes, which are alone included in this type, are herbaceous or suffruticose plants, with alternate ascidiate leaves, and the petioles slightly sheathing at the base. The inflorescence is in terminal

Nepenthes indica.

B. Entire plant with ascidiate leaves.
(*a*) Bud of flower before opening.
(*b*) Æstivation shewn to be oppositely imbricated by a plan of a transverse section.
(*c*) Sterile flower.
(*d*) Pistilline flower.
(*e*) Fruit, 4-sided and 4-celled.
(*f*) Longitudinal section, shewing dissepiment and seeds.
(*g*) Transverse section, shewing the 4 cells.
(*h*) Seeds natural size.
(*i*) Seed enlarged and dissected, to shew the arillus or lax tunic.
(*k*) Seed isolated, the arillus being removed.
(*l*) Section of ditto, to shew the situation of the embryo according to Richard.
(*m*) Ditto, according to Adolphe Brongniart.
(*n*) Embryo isolated.

racemes; the flowers monochlamydeous and diœcious, the perianth inferior and 4-sepalled, with an opposite imbricate æstivation. The stamens are definite (16), with monadelphous filaments and 2-celled extrorse anthers dehiscing longitudinally. The germen is superior, 4-angled and 4-celled, the ovules indefinite and ascending, and attached to the sides of the dissepiments. The stigma is sessile and simple. The fruit is a 4-sided, 4-celled, 4-valved capsule, with dissepiments proceeding from the middle of the valves. The seeds are small, albuminous, indefinite, and fusiform, with a loose outer covering (arillus?). The albumen is fleshy, oblong, small, including the embryo within it. The cotyledons are two in number and opposite, and the radicle variable in its direction. Richard found it at the extremity opposite to the hilum, while Adolphe, Brongniart, and Nees Von Esenbeck, describe it as being turned towards the hilum.

(1766.) Hence, selecting the chief associating general characters, the *Nepenthaceæ*, differentially considered, are hypogynous *Asarinæ*, with monadelphous stamens, perianth imbricate in æstivation, embryo 2-lobed, and leaves ascidiate.

(1767.) *Nepenthes* is a name of classic celebrity. Every one is familiar with the beautiful passages, perhaps allegorical or partly so, which occur in the

Odyssey,* and numerous attempts have since been made to determine whether the Nepenthes of Homer was the produce of a real or an imaginary plant.

Some critics, analysing the word, and finding it composed of νη the negation, and πενθος, grief, have supposed it to be a merely figurative account of the influence which beauty and female conversation have in assuaging sorrow, for it will be remembered that it is Helen, the wife of Menelaus, who is represented as pouring out the Nepenthes for Telemachus. Others, however, have believed themselves able to identify the plant referred to by Homer; thus the *Elecampane, Inula,* HELENIUM, which bears the name of *Helen,* has been triumphantly pointed out by Pliny; while Galen refers to the bugloss, Plutarch to the borage, and other commentators to coffee and to opium, or to some one of the many 'drowsy syrups of the East,' as those procured from hemp or henbane, which latter speculations seem to enlist the greater probabilities on their side.

(1768.) This much is however certain, that even if the Nepenthes of Homer were a vegetable production, it was not yielded by the plant to which the name in modern times belongs. But although it is possessed of no very obvious sensible properties, and cannot, like the old *Nepenthes,* alleviate sorrow, calm anger, and cause men to forget their greatest griefs, still it is a most curious plant, scarcely less wonderful in its structure than that of Homer for its quality.

(1769.) The pitchers which this plant bears are modifications of the foliage, such as are met with in different forms in several other plants, as in Dionæa, Drosera, Sarracennia, &c. and, from some of them being furnished with organs of prehension, *i. e.* the means of catching small animals, and all with those of retention, it is not improbable that they are the foreshadowings of the organs of mastication and digestion in animals. Those who are curious in the subject, may see some observations relating to the physiology of these organs in an essay entitled "Adumbrations of a Stomach in Vegetables," which I published a few years ago in Brande's Journal of Science.

(1770.) Besides the insects and vermin they entrap, these ascidia often contain a considerable quantity of water; two, three, or even four ounces, in which live animals are sometimes met with And it is said that not only have travellers occasionally found great relief from the fluid stored up in their receptacles, but that various wild beasts resort to them when thirsty, as may be shewn by the marks of their teeth upon the sides; and my friend, Mr. Smily, tells me that apes so frequently drink out of them, that in India they are called 'Monkey-cups.'

RUMICINÆ.

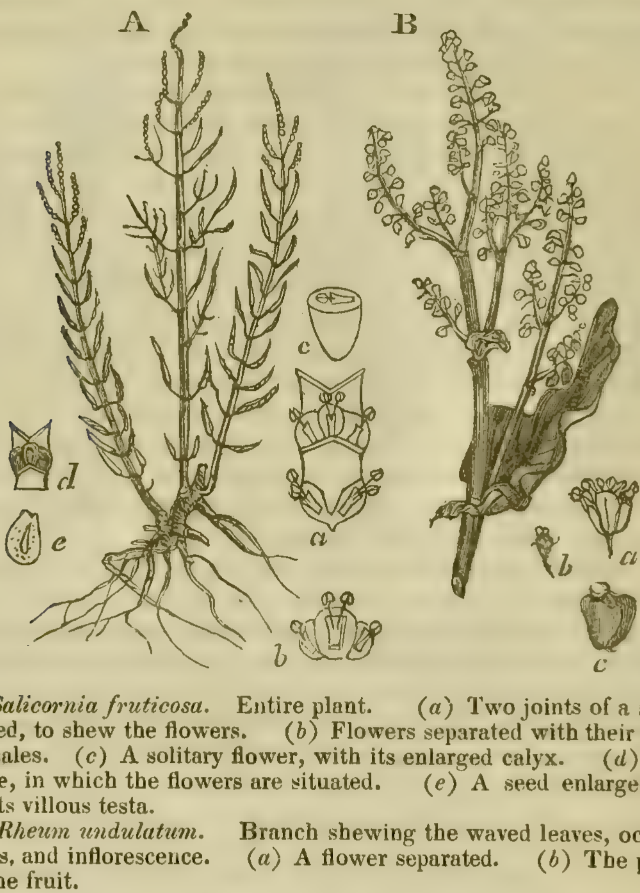
(1771.) Five groups of associated plants belonging to the order *Querneales,* and which agree with the Rumices or Docks, in certain general characters, are referred to the section RUMICINÆ.

* 'Αυτικ' αρ' ἐις ὀινον βαλε φαρμακον, ενθεν ἐπινον,
Νηπενθες τ' ἀχολον τε, κακων ἐπιληθον ἀπαντων·
'Ος το καταβροξειεν, ἐπην κρητηρι μεγειη,
'Ουκ ἀν ἐφημεριος γε βαλοι κατα δακρυ παρειων,
'Ουδ' ἐι ὀι κατατεθναιη μητηρ τε πατηρ τε,
'Ουδ' ἐι ὀι προπαροιθεν ἀδελφεον ἠ φιλον υἱον,
Χαλκῳ δηϊοῳεν, ὁ δ' ὀφθαλμοισιν ὁρῳτο.

Odyss. Lib. iv. *v.* 220 *et seq.*

(1772.) From *Petiveria*, *Beta*, *Scleranthus*, *Nyctago*, and *Polygonum*, the respective normal genera of each, these types are named the *Petiveriaceæ*, *Betaceæ*, *Scleranthaceæ*, *Nyctaginaceæ*, and *Polygonaceæ*.

(1773.) The RUMICINÆ are in a great measure coincident with the *Holoraceæ* of Linneus, and the included types, with his sub-orders, or rather with the *Nyctagines*, *Polygoneæ*, *Atriplices*, and *Amaranthi* of Jussieu.



A. *Salicornia fruticosa*. Entire plant. (*a*) Two joints of a spike enlarged, to shew the flowers. (*b*) Flowers separated with their calycine scales. (*c*) A solitary flower, with its enlarged calyx. (*d*) The foveolæ, in which the flowers are situated. (*e*) A seed enlarged, to shew its villous testa.

B. *Rheum undulatum*. Branch shewing the waved leaves, ocreate stipules, and inflorescence. (*a*) A flower separated. (*b*) The pistil. (*c*) The fruit.

(1774.) When Linneus either designedly or by chance gave the variation of the original oleraceæ, which has caused so much useless criticism, as the name of his twelfth natural order, he at the same time extended its signification and associated with the ordinary pot-herbs of the ancients, the Laurels and other plants, which, although not distantly related to the Docks, are not so intimately connected as to justify their arrangement in a common section. In modern systems a change has been therefore neces-

sarily made, and the Lauri and other less accordant plants being excluded, the associated types are reduced to those, which contain the chief of the *Olera* of the ancients, or at least such plants as they seem to have been, viz. vegetables of rapid growth, but so slightly nutrient that the word became proverbially expressive of mean and scanty fare.

(1775.) The *Rumicinæ*, collectively considered, are monochlamydeous Querneales, with herbaceous, rarely shrubby or arboreous stems and simple leaves. Their perianths in general are coloured and imbricate in æstivation, the germen free, and the seeds albuminous, the albumen mealy, and the embryo curved.

The albumen is sometimes but rarely wanting; when present, the embryo is curved round it, when evanescent or abortive, the cotyledons are folded round the radicle.

(1776.) Petiveriaceæ. *Petiveria* and *Phytolacca* are the normal genera of two small subtypes, which, together, form the *Petiveriaceæ*.

(1777.) The *Petiveriaceæ* are herbs or shrubs, with round or irregularly angled stems and branches, with imperfect nodes. The leaves are alternate, simple, entire, and often with minute pellucid dots. In the subtype *Petiveridæ* stipulæ are present, in the *Phytolaccidæ* there are none.

The flowers are united, regular, often racemose, rarely axillary and solitary.

The perianth is single, for the most part coloured, persistent, and 4-5 leaved or deeply 4-5 cleft, with an imbricate æstivation. The stamina are hypogynous, (rarely perigynous,) free, definite, or indefinite, 5 or more, and alternate with the sepals. The anthers, 2-celled. The germen is superior formed of one or more carpels, each containing one ascending ovule. The stigmata are distinct, and equal to the ovaries in number.

The fruit is baccate or dry, with the carpels connate, deeply lobed or solitary, and hence 1 or many celled, each cell being monospermous. The seeds are erect, the albumen mealy or evanescent, and the embryo curved either round the farinaceous albumen, or the cotyledons are spirally folded round the radicle.

(1778.) Hence, selecting the chief general characters, the *Petiveriaceæ* differentially considered, are ab-involucrate *Rumicinæ* with 5 or more stamens, alternating with the lobes of the perianth, and a 1-10-celled ovary with monospermous locules, erect seeds, inferior radicle, and alternate leaves.

(1779.) The two subtypes differ in several important particulars, so that they have sometimes been disjoined and made into distinct families, but this separation does not seem advisable.

(1780.) In the *Petiveridæ* the leaves are stipulate, the ovary 1-celled, the stigmas lateral, and the albumen evanescent or abortive, the cotyledons being spirally folded round the radicle.

(1781.) In the *Phytolaccidæ* the leaves are exstipulate, the ovary one or many-celled, the stigmas terminal, and the seeds albuminous.

(1782.) *Petiveridæ. Petiveria* was dedicated by Plumier to the memory of *Mr. James Petiver*, an apothecary, of London, and Fellow of the Royal Society, who wrote several works on natural history, and was much esteemed for his talents and industry, notwithstanding, he made himself enemies by his dry and

caustic humour, which is thought to have been covertly indicated by the acrid properties of the plant named after him. The Petiveriæ are West Indian herbs, and in pastures are troublesome weeds, giving an unpleasant garlick-like flavour to the milk of the cows that feed upon them.

The juices of *P. alliacea* are so acrid that if a small portion be chewed it burns the mouth, and renders the tongue as dry and black and rough as it appears in cases of malignant fever. It is said to be obnoxious to insects, and, notwithstanding its nauseous odour, is used to keep them away. The negroes consider it a sudorific, and it is said that vapour-baths, or fumigations of *stinking vervain,* as it is called, will restore motion to paralyzed limbs. Pintados are almost the only animals that seem to covet the plant as food, and they are said to be extremely fond of it: hence its common name of *Guinea-hen-weed.*

(1783.) *Phytolaccidæ. Phytolacca,* so called from its being a plant the fruit of which affords a fine red juice resembling carmine or lake, is the American *Poke,* the *Pocan* of Virginia. *P. decandra* is the most valuable species: it has been naturalized to the gardens of the scuthern and middle parts of Europe: its buds and shoots are eaten as asparagus, and its young leaves as spinach. When the foliage is fully developed, it is no longer esculent, as an active principle then abounds in its sap, which is both emetic and cathartic. The expressed juice is called *Mechoacan* in Canada, and two teaspoonsful are administered as a dose. It is reported to be of much service in rheumatism, and especially in those pains which follow secondary symptoms. An ounce of the dried root infused in a pint of wine operates kindly as an emetic in doses of two spoonfuls and is preferable to most others, as it scarcely alters the flavour of the wine. It resembles ipecacuanha in its mode of action, but is slower in producing its effects, and remains longer in operation. The fruit partakes of the properties common to the rest of the plant, and even imparts its purgative powers to the flesh of animals, such as pigeons, that feed upon it; as appears from several cases reported by Dr. Rust, in which some of the students of the college of Priceton, in the United States, suffered severely from eating pigeons that had been fed upon the pocan-berries; nevertheless they are given to domestic fowls in France without injuring them as food. The juice of these berries stains paper of a beautiful purple colour, but it is fugacious; if some mordant were known it might be valuable as a dye. Loudon says it has superseded the use of elderberries, in giving a deep colour to port-wines; for the vignerons of Portugal having been complained against for mixing elderberries with the grapes, the government ordered all the elder-bushes to be cut down and destroyed before the berries were formed; but the *Phytolaccæ* having been omitted in the proscription, the pocan berries were at once adopted in their stead. These berries when fermented yield a liquor from which alcohol may be procured by distillation.

According to the chemical investigations of *Braconnot,* this plant contains a very large proportion of potash, 100lbs. of its ashes giving 66lbs. 10 oz. of dry salt, which yield 42lbs. of pure caustic potash. It has therefore been proposed to cultivate it in France as a source of alkali; and as beyond this, its young shoots and leaves are eatable, and its berries will afford a colouring matter and spirit, its culture may in some parts be profitable.

(1784.) *Rivina,* an allied genus, commemorates Rivinus, professor of botany at *Leipsig.* Linneus has observed, with his usual readiness, that the name of Rivinus has been given to a shrub always covered with leaves and fruit, in allusion to

the merit of his works. The hoop-withy of Jamaica is *R. octandra*, and its long flexile stalks are made into hoops in the West Indies. The berries form the chief food of the American thrush and nightingale. They contain a very oily seed, and after the birds have swallowed many of them, they are frequently seen to fly to the next pepper plant (capsicum,) and pick a few pods; instinct directing them to a condiment necessary to aid the digestion of such oleaginous heavy food. (*Loudon.*) In Rivina the albumen is very much reduced in quantity, and it thus forms, with the unilocular fruit, the transition from the preceding subtype to this. And Dr. Brown has pointed out another link as being formed by a species of *Phytolacca*, in which, as in *Gisekia*, the ovaries are discrete.

(1785.) BETACEÆ. The beet or mangel-wurzel, the marsh samphire, the spinach, the orache, and several other oleraceous plants, form, with the globe and velvet amarants, the cockscombs (or celosiæ,) and their allies, two subordinate groups: they are generally separated as distinct orders, but their structure is so similar, notwithstanding the difference of their habit, that they are, perhaps, sufficiently distinguished from each other when admitted as subdivisions of a common type, which, from the first-named genus, may be called BETACEÆ; and the two sub-types, from *Chenopodium* and *Amarantus*, the *Chenopodidæ* and *Amarantidæ*.

(1786.) The *Betaceæ* are herbs, under-shrubs, or shrubs, with round or irregularly angled, subarticulate stems and branches. Their leaves are simple, alternate. (rarely opposite,) and destitute of stipulæ. The flowers are mostly united, but occasionally separate, and either solitary or disposed in axillary or terminal heads, spikes, cymes, or panicles. The perianth is free, sometimes coloured, 3-5 leaved or deeply cleft, imbricate in æstivation and persistent: in one subtype (chenopodidæ) ebracteate, in the other with 2 bracteolæ at the base. The stamens are hypogynous, or perigynous, 5 or less in their number, and either free or connate. The germen is superior, sometimes slightly adherent to the calyx, one-celled, and one or many ovuled: the styles are free or connate, and the stigma simple or compound.

The fruit is a dry membranaceous utricle, rarely becoming succulent, enclosed by the calyx, one celled, and 1 or many seeded, the seeds being erect, the albumen mealy, (rarely evanescent,) the embryo curved, the radicle next the hilum, and the plumula inconspicuous.

(1787.) Hence, selecting the chief general characters, the Betaceæ, differentially considered, are *Rumicinæ* with herbaceous or petaloid perianths, stamens 5 or less, opposite the sepals, the germen simple and 1-celled, one or more seeded, and the seeds erect.

(1788.) In the *Chenopodidæ* the flowers are inconspicuous, the perianth herbaceous and ebracteate, the stamens free, chiefly perigynous, the seed solitary, and the albumen sometimes evanescent.

(1789.) In the *Amarantidæ* the flowers are more shewy, the perianth being often coloured and involucrate; the stamens often connate, chiefly hypogynous, the seeds one or more, and the albumen always present.

(1790.) *Chenopodidæ.* (Atriplices of Jussieu, Chenopodeæ of Ventenat, Brown, and others.) The numerous species of chenopodium, or goosefoot, so called from the general shape of the leaves, are for the most part innocuous, and esculent, but slightly nutritious plants, growing abundantly in waste places, and in the more barren soils; a few, however, are possessed of active properties,

and are used as medicines. The smell of some is agreeable, but of others nauseous in the extreme.

(1791.) *Chenopodium ambrosioides*, the Mexican tea, has a very strong and pleasant odour, and is used in some parts of America instead of tea. It has also been administered with advantage in nervous diseases, and Plenck commends it in the treatment of chorea.

(1792.) *C. anthelminticum* is much esteemed in the United States as a vermifuge, and it is probably one of the most powerful known. Its expressed juice, or a decoction of its leaves, or its seeds in powder, or the essential oil, which it yields in abundance, are all useful anthelmintics; but the latter, known as *worm-seed oil*, is the most frequently employed.

(1793.) *C. Botrys* is reputed by the French physicians to be a valuable expectorant, and is said to have been employed with much advantage in catarrh and humoral asthma. *C. hybridum* is reported on the authority of Tragus to be deleterious, both to men and swine, but this statement requires confirmation.

(1794.) *C. Baryosmon* is remarkable for its extreme fœtidity, and might probably be applied to the same purposes as our indigenous *C. olidum*, one of the most intolerable of all stinking plants. These, like other vegetable substances peculiar for their nauseous odours, are valuable antispasmodics and emmenagogues; and, although not at present much used in medicine, *C. olidum* is held in repute by our village doctresses, and supplies are constantly sent to Covent garden market from Mitcham, where it is cultivated for sale. M. Chevalier, by placing the leaves of this plant under a suitable apparatus, discovered that it disengages ammonia during its vegetation: a singular and important fact.

(1795.) *C. maritimum* is resorted to in some situations, where it abounds as a source of soda, which may be procured from most maritime vegetables.

(1796.) C. album, bonus Henricus, and the other insipid inodorous species, are eaten in some places as greens; they afford a very passable kind of spinach, and were much esteemed before the introduction and great improvement of our present cabbages and coleworts.

(1797.) In Peru, *C. Quinoa* is a very important economical plant; its seeds, which abound with bland farina, are there called '*petty rice*,' and form a common article of food; its leaves are also eaten as green vegetables.

(1798.) *Atriplex*, an allied genus, the *atrum olus* of the ancients, was so called on account of the dark colour of the foliage in some species. An impossible derivation of its present name is often given (from α and τρεφειν,) which is asserted to have reference to the little nutritious matter its leaves and seeds contain. Several atriplices are, however, esteemed as food on the continent, although not much grown here; such as *Atriplex hortensis*, the garden *orache*. A. Bengalensis is also eaten as spinach, and *A. portulacoides* makes a good pickle. The seeds of *A. angustifolia* are said by Smith to be possessed of emetic powers; and the same has been stated regarding those of the common orache.

(1799.) The *Salsolæ*, which are common on the sea shores of most parts of the world, are of much economical importance on account of the soda they afford. In the south of France, and on the Mediterranean shores of Spain, especially in the *huerta* of Murcia, they are cultivated extensively, and when burned, their ashes form the *barilla* of commerce, as the ashes of sea-weeds form kelp. During the war, when the demand for soda was great, and the gains on its production large, the growers extended their salsola fields inland, but found,

to their disappointment, that although, as long as the land sloped upwards from the sea, the salsolæ were rich in soda, as soon as they began to slope inland, the plants ceased to produce soda, and only furnished potash. It appears to be essential for the elaboration of alkali that they should be subject to the influence of the sea winds impregnated with saline vapours, and bearing to them particles of salt.

(1800.) Beet is another important plant, mention of which cannot be omitted. It is well known as an excellent vegetable; its leaves are eaten as spinach, their midribs and stalks as chard, and their roots in salad, or as an ingredient in soups and ragouts. In some places beet is cultivated solely or chiefly for its stalks, which are bound round with straw and blanched, (as are also the leaves of artichokes), forming the beet-chards. In others the root is principally desired; and, from the great size to which it grows, and its highly nutritious qualities, it has been called the "mangel wurzel," or root of scarcity. Of late years it has been much cultivated in this country: it forms an excellent mutation crop, and yields an abundance of wholesome food for cattle during the winter. The roots occasionally are known to weigh 20, 30, or even upwards of 60 pounds; some of the latter weight have been grown by my friend, Mr. Gibbs, of Brompton.

(1801.) There are several species and varieties of beet, some of which are preferred for one and some for another purpose. The white Sicilian beet, *Beta Cicla* (Sicula?) is that which, from containing most saccharine matter, is chiefly cultivated in France for the manufacture of sugar. And although the sugar is neither so good as that from the cane, nor can it be made at home so cheaply as the better commodity could be imported from abroad, still a mistaken policy condemns the nation to continue to bear in a time of peace a burden, to which it at first was driven by the necessities of war. The quantity of sugar made from beet-root in France in the year 1828 was estimated at four millions kilogrames, equal to upwards of 8 and near 9 millions lbs.

(1802.) The marsh samphire (*Salicornia*, § 1773, A.) the spinach (*Spinacia*), the Malabar nightshade (*Basella*), and other plants belonging to this subtype, are esculent vegetables, and more or less valued as potherbs in different countries and by different people.

(1803.) *Amarantidæ*. The *Amarants* or undying ones, (*α, μαραινω*), have so been named from their persistent coloured calyces retaining their hues, and being but little changed in appearance by death. Several are favorite garden plants, such as the prince's feather, (*A. hypochondriacus*), love lies bleeding (*A. caudatus*), the melancholy flower, (*A. melancholicus*,) &c.; to which may be added, the beautiful globe amarant (*Gomphrena globosa*); and the splendid cockscombs (*Celosiæ*.)

(1804.) Like the preceding type these plants are innocuous, and many of them abounding in mild nutritious juices are eaten as potherbs, such as *A. Blitum*, in Gascony; *A. oleraceus, farinaceus, gangeticus*, and *spinosus*, in India; *A.* Carain and celosioides, in Brazil and Canada.

(1805.) *A. caudatus* and some of the *Gomphrenæ* are slightly astringent, and from their mucilaginous properties have been employed medicinally in pectoral complaints. The *Gomphrenæ* enjoy a great, and it is to be feared, an undeserved reputation in Brazil; *G. officinalis* and *macrocephala*, are boasted as panaceas, and considered as specifics in intermittent fever, colic, and diarrhœas, as

sovereign remedies in all diseases of the stomach and bowels, and as antidotes to the bites of serpents. Hence their Brazilian name *Para* or *Pera-todo*, which means 'good for everything;' the credulous natives, and their not less credulous physicians, appearing to believe that everlasting flowers could confer immortality on man.

(1806.) SCLERANTHACEÆ. *Scleranthus*, the knawel, and *Illecebrum*, the fester-wort, with *Pollichia*, and some few other genera, are associated to form this border-type. These plants shew a double affinity, being connected on the one hand with the *Chenopodidæ*, and on the other with the *Dianthaceæ*, or pinks and carnations; and hence some difference of opinion exists as to their arrangement. Bartling refers them, along with the two preceding types, to the neighbourhood of the *Dianthaceæ* or *Caryophylleæ* ; but if the relationship of *Scleranthaceæ* with *Betaceæ* and *Petiveriaceæ* be acknowledged, and of it there is no doubt, it does seem that the nearest affinity of the whole, as monochlamydeous flowers, is rather with the *Polygonaceæ* of the Querneales, than with the highly developed corollaceous groups of the dichlamydeous *Rosales*.

(1807.) The *Scleranthaceæ* are herbaceous or suffruticose plants, having simple, opposite, or verticillate leaves, with or without stipulæ. The inflorescence is usually in dichotomous cymes. The flowers are small, regular, and united. The perianth single, the sepals 5-3-4, either distinct or connate, and imbricate in æstivation. The stamens are definite (1-10) and perigynous, being exserted from the faux of the calyx, and opposite the sepals. The filaments are free, and the anthers 2-celled. The germen is superior, unilocular, and uniovulate. The styles 2-3, free or connate, and the stigmata simple. The fruit is utricular, 1-celled and 1-seeded, indehiscent, and sometimes surrounded by the hardened persistent calyx. The seed is solitary, pendulous from the apex of a funicle which arises from the base of the locule, and albuminous. The albumen is mealy and the embryo curved, and the radicle next the hilum.

(1808.) Hence, selecting the chief differential characters, the *Scleranthaceæ* are *Rumicinæ*, with herbaceous perianths, opposite, definite, perigynous stamens, a solitary seed pendulous from a lengthened funicle, mealy albumen, and curved embryo.

(1809.) The genera here associated are distributable into two or three subtypes, the *Scleranthidæ* and the *Illecebridæ*, to the latter of which the *Pollichidæ* are added by some authors.

(1810.) The *Scleranthidæ* have exstipulate leaves, a tubular indurated calyx, which invests the ovary, and the embryo curved round the albumen.

(1811.) In the *Illecebridæ* the leaves have scarious stipulæ, and the flowers scarious bracteæ. The sepals are often distinct, and the curved embryo lies on one side of the albumen.

(1812.) The *Pollichidæ* are distinguished from the Illecebridæ by having the leaves somewhat whorled, and the bracteæ and sepals becoming succulent, giving the fruit the appearance of a berry.

(1813.) These plants are chiefly obscure weeds, possessing little either in appearance or properties to attract attention. They are slightly astringent, but have scarcely been applied to any useful purpose. The Swedes are said to alleviate the toothach by inhaling the vapour of a decoction of knawel, *Scleranthus annuus*. In several parts of Europe the roots of *S. perennis* are attacked by the *Coccus Polonicus*, which, like the Coccus ilicis and C. cacti, yields a fine crimson

dye. This insect is said also to feed on the *S. annuus*, and on the roots of *Potentilla anserina*. *Paronychia*, *Anychia*, and *Herniaria*, the whitlow, felon, and rupture-worts, received their names from their supposed efficacy in the cure of disorders over which they had no influence, and they have consequently long been discarded from our lists of medicines.

(1814.) Nyctaginaceæ. *Nyctago* or *Mirabilis*, the marvel of Peru, with *Abronia*, and the other genera which form this type, are herbaceous, shrubby, or arborescent plants, with occasionally tuberous rootstakes and knotted stems. Their leaves are exstipulate, opposite, rarely alternate, and almost always unequal.

The inflorescence is axillary or terminal, the flowers solitary or aggregate, and surrounded by a calyx-like involucrum of one or more leaves, one or more flowered, and persistent.

The perianth is single, corollaceous, monophyllous, and tubular; the tube contracted above the germen and persistent; the limb plaited in æstivation, twisted to the left, and deciduous. The stamens are definite, equal in number to the folds of the perianth, hypogynous, and exserted from an annular disk. The filaments are attached to the tube of the perianth, and incurved in æstivation. The anthers are 2-celled and burst lengthwise, and the pollen is in roughish round grains. The germen is superior and free, although covered by the tube of the perianth, unilocular, and monospermous, and the ovule erect. The style is single and terminal, and the stigma capitate or papillose.

The fruit is indehiscent, being a thin membranaceous utricle, 1-seeded, and included within the indurated tube of the perianth. The testa of the seed is united with the pericarp, the albumen is farinaceous, and the embryo peripherical and curved; the radicle is inferior, the plumula inconspicuous, and the cotyledons foliaceous.

(1815.) Hence, differentially considered, the *Nyctaginaceæ* are exocreate Rumicinæ, with a 1-celled 1-seeded ovary, included within the hardened plicate perianth, albuminous seeds, inferior radicle, and foliaceous cotyledons.

(1816.) The *Marvel* of Peru, the *Admirabilis* of Clusius, and the *Mirabilis* of most modern writers, is so beautiful and fragrant a plant, that it well deserves its name, which, however, as it is only an adjective term, had better have been made the specific than the generic denomination, and this the more especially as Van Royen's *Nyctago* or night-blower, which is the name preferred by Jussieu, is indicative of the late hours at which the blossoms open. *Mirabilis* or *Nyctago dichotoma*, is called "the four o'clock flower" in the West Indies, on account of its opening regularly at that hour in the afternoon.

(1817.) The roots of the *Nyctagines* contain a purgative principle, which renders them useful as cathartics; one of them was formerly thought to afford the jalap of medicine, and was hence named Mirabilis Jalapa, and although not the true jalap, its roots are not unfrequently powdered and mixed with the genuine drug.

M. dichotoma possesses the same properties as the preceding, but the root of *M. longiflora* is more potent than either. The seeds of these plants contain an abundance of farinaceous albumen, which the Japanese separate and use as food: they likewise extract a sort of pigment from the fruit.

(1818.) The roots of the *Boerhaaviæ* possess both cathartic and emetic powers. Aublet tells us that *B. diandra* is used in Guiana instead of ipecacu-

anha; and *B. tuberosa* is employed as a cathartic in Chili and Peru. The natives of the above countries eat the roots, which afford a nutritious food when cooked—heat removing their purgative principle; and Jacquin says that the leaves of *B. diffusa* form a common potherb in America, notwithstanding its roots are laxative, like the other species.

(1819.) The *Abronias* are extremely delicate and beautiful plants, but of no known use. The Pisonias are remarkable for being shrubs and trees in a large group of herbaceous genera. *Pisonia aculeata,* which is a scrambling tree devoid of beauty with reclining thorny branches, is very troublesome to travellers in the savannahs of the West Indian isles, by arresting all who pass, its strong incurved spines fastening themselves to the clothes or flesh, and almost forbidding transit. Its fruit also is glutinous and burry, and thus fastens itself upon the wings of ground-doves and other birds even to such an excess, that from the load they are unable to fly, and hence are easily taken.

P. fragrans is reputed to be an active emetic; and in a memoir read before the Royal Academy of Medicine in Paris, it is said to be used as such in Cuba.

(1820.) Polygonaceæ. The knot-wort, the rhubarb, the sorrel, and the dock, which, with other associated genera, form this type, are herbaceous, rarely shrubby plants or trees, with knotted stems and branches, simple alternate leaves, revolute in vernation, dilated sheathing petioles, and ocreate (or rarely lanate) stipules.

The flowers are in general united, sometimes separated, and either solitary or disposed in fascicles or racemes. The perianth is free, regular, persistent, synsepalous, often coloured, with a 3-6-parted limb imbricate in æstivation. The stamens are definite, perigynous, exserted from a torus, lining the bottom of the calyx. The filaments are free, straight in æstivation, and the anthers 2-celled and introrse, with a longitudinal dehiscence. The germen is superior, 1-celled, and contains a solitary erect ovule. The styles 2-3, and the stigmata simple or plumose.

The fruit is dry and indehiscent, utricular or nut-like, and often covered by the persistent calyx. The seed is erect, the albumen farinaceous, very rarely evanescent, and fleshy. The embryo curved and inverted, its radicle being remote from the hilum, and the cotyledons narrow, or when broad flexuose.

(1821.) Hence, differentially considered, the *Polygonaceæ* are stipulate *Rumicinæ* (the stipules almost always in the form of ocreæ), with solitary erect albuminous seeds, inverted embryo, and superior radicle.

(1822.) Along with many of the most common weeds which overrun waste lands in every latitude, there will be found in this type several important officinal and dietetic plants, the chief of which are the rhubarbs, the sorrels, and the buckwheats. Another striking example is afforded by this type, of homomorphous plants being homogeneous likewise; for there are few that possess more accordant botanical characters, or that agree more closely in properties and in chemical constitution. Admirable illustrations are also here supplied of the differences occasioned in different instances by the different relative proportions in which the several common constituents are found. The active principles added to the inert lignin and bland farinaceous substance of the plants are astringent and cathartic, acidity being occasionally superinduced.

In the majority of cases these are so equally blended and in such small propor-

tions to the inert ligneous matter with which they are combined, that the plants exhibit no very decided properties, and are regarded as useless weeds; but when either the one or the other becomes predominantly developed, they then become of economical importance either as food, as medicines, or in the arts. Of the first the sorrels, of the second the rhubarbs, and of the last the bistorts and the sea-side grape, are familiar examples.

One more general remark may serve further to elucidate this point. The different proximate principles are developed in different degrees in different parts of the plants. The tannin and gallic acid, upon which their astringency depends, are chiefly found in the roots and rootstakes, where the cathartic power also resides. Hence the value of rhubarb in diarrhœa as an astringent purge. The acids prevail in the leaves, leaf-stalks, and other immature parts; hence the foliage of the sorrels and the leaf-stalks of the pontic rhubarb are employed as articles of food, making excellent spring tarts and sauces. And hence also the mealy albumen of the seeds, being destitute of all the more active principles found in other parts of the plants, afford, as in the buck-wheat, a large quantity of wholesome nutritious food.

(1823.) The *Coccolobæ* or sea-side grapes, are arborescent plants, natives of the West Indies and America, the persistent calyces of which become enlarged and succulent, and, by investing the clusters of seeds, give them somewhat the appearance of raisins, whence the common name.

The fruit of *C. uvifera* is slightly astringent, but very agreeable when eaten with sugar, and from it a refreshing drink, and also a sort of wine, is made. The leaves are large, and they, as well as the wood and bark, contain a very astringent dark-red sap, from which, or from a decoction of the wood and bark, Jamaica Kino is prepared by inspissation. The wood is likewise employed as a red dye. The seeds are said to contain too much purgative matter to be used as food, and too little to be employed as medicine. The wood when large is valued for cabinet-work.

The fruits of other species, such as C. nivea and pubescens, are eatable; and these, as well as the rest of the genus, resemble C. uvifera in general properties.

(1824.) Polygonum is a very extensive genus, containing the knot-grasses, bistorts, persicarias, and buck-wheats, of our waysides, fields, and gardens. They grow in almost any soil, some being aquatic, and others flourishing in sandy sterile tracts.

(1825.) Polygonum amphibium is a fine shewy water-plant, but one of the most troublesome to eradicate from lands recovered from rivers, or drained lakes and marshes. The subaquatic or subterranean stems root at every joint, and extend to a surprising length, rising through the superincumbent soil. By fallowing and disturbing the surface the leaves may be prevented shewing themselves for two or three years, but if such an alluvial field be laid down in grass, or suffered to remain a season quiet, it will be overrun with the polygonum. Many tracts in Scotland, says Loudon, which have been gained from rivers and æstuaries for an unknown series of years, still abound with this plant, and as under such circumstances it never advances so far as to flower and seed, the individuals must be prolongations of the same plants, which formerly were suspended in the water.

The root-like stems of this polygonum bear some resemblance to sarsaparilla,

and, according to Coste and Willemet, they are substituted for the foreign drug by the herbalists of Nancy: these authors also report that the polygonum resembles true sarsaparilla in its properties, and that the apothecaries and druggists in Lorraine use it in preference.

(1826.) *P. antihæmorrhoidale* is the *Cataya* or *Ervo do Bicho* of Brazil. On account of its astringency it is there esteemed as a fomentation herb, and is in frequent use in the preparation of baths, washes, and poultices. The juice, as well as an infusion of its ashes when burned, are employed by the Brazilians in the clarification of syrup, and the condensation of sugar.

(1827.) *P. aviculare* affords, by its numerous seeds, which are too small to be profitably collected as human food, an abundant supply of nutritious food for birds, whence indeed it has derived its specific name. These seeds are said to possess emetic and cathartic powers; and De Candolle, mentioning the report, which however requires confirmation, asks whether these properties do not reside in the seed-coats rather than in the seeds. Thunberg states that in Japan a blue dye resembling indigo is prepared from this plant, which is one of our most common weeds. *P. chinense* and *P. barbatum* are also said to yield a sort of indigo. At the Cape of Good Hope the latter is esteemed as a diuretic, and in India an infusion of its leaves (called *Aat-alarie*) is prescribed by the native practitioners to alleviate the severe pains of colic.

(1828.) *P. Bistorta* is one of the more powerful vegetable astringents; its root contains tannin and gallic acid in abundance, so that it is not only very useful in cases of diarrhœa and other fluxes, but might also be employed in the tanning of leather, being equivalent it is said to double the quantity of oak-bark. The roots abound in fecula, which, when the tan is separated, may be used as food, bread is made of it, as well as of *P. Sibiricum*, in Russia. Scheele discovered oxalic acid in this plant. Its seeds are commonly fed upon by birds, and do well to fatten poultry. The young shoots of bistort, called 'Easter-giant,' were formerly eaten in the north of England in the provincial 'herb-puddings;' and in the neighbourhood of Manchester they are still brought to table as greens.

(1829.) *P. Fagopyrum* is the buck-wheat, or rather beech-wheat, so called from the seeds resembling beech-mast. This is a very valuable plant, growing on the worst and poorest soils, and affording an abundance of wholesome but not very nutritious food, and it likewise stands but a short time on the ground. In China, and various parts of the East, it has been long cultivated as a bread-corn. It was introduced into Europe by the crusaders, and hence in many parts of France, where it is commonly grown, it is called Saracen-corn; and so much is it esteemed, that M. Bory St. Vincent says he was shewn in Belgium the tomb of the person who it is reported first introduced it into that country. Buck-wheat contains gluten, although not in such large quantities as wheat. Its flour is made into bread, and used in cookery in Germany, Poland, and various parts of the continent, but in England it is little employed, excepting in the manufacture of cakes and crumpets. The seeds are said to be excellent food for horses and poultry, the flowers for bees, and the green plant for cattle, sheep, and swine. *P. Tataricum* is applicable to the same purposes, and is in some places preferred on account of its seeds being larger. *P. emarginatum* also affords alimentary seeds, which are eaten in China; and in Cochin-china *P. odoratum* is employed to season various dishes.

(1830.) *P. hydropiper*, the water-pepper, is a hot and acrid plant. The seeds, according to Bulliard, have been substituted in the French provinces for pepper. Its sap is slightly acid, for it will redden vegetable blues, and is so acrid that vesication follows its application to the skin. It is reputed to be a powerful diuretic, but its activity is lessened or destroyed by drying, therefore the plant should be used fresh: it will dye wool of a yellow colour. In South America the leaves of *P. hispidum* are smoked instead of tobacco. In Japan the roots of *P. multiflorum* are eaten raw, because when cooked they become bitter, which is a very unusual circumstance—most plants losing bitterness, and often becoming sweeter, on the application of heat.

(1831.) In the rhubarbs, the astringent principles so prevalent in the *Coccolobæ* and *Polygona* become blended with a cathartic one, of which an anticipation appeared in *P. aviculare*. The roots or root-stakes of all the species of *Rheum* [§ 1773, B], are more or less purgative, but that which affords the true officinal rhubarb is even now not decidedly known. R. Rhabarbarum, R. Rhaponticum, R. palmatum, and others, have been in turn referred to: and, besides the probability that some of the reputed species are only varieties, it is not unlikely that the roots of more than one may be the rhubarb of different countries. Indeed, two or more which have been cultivated in England afford roots the medicinal properties of which are equal, or very little inferior to the drug of foreign growth. (Vid. Med. Bot. 25, 117.)

The cathartic powers of the rhubarbs is believed to depend on a peculiar proximate principle called *Rhubarbarin*; this is however blended, and its action modified, by the bland fecula and astringent matters with which it is combined. Oxalic acid is also found in rhubarb in the form of oxalate of lime.

The leaf-stalks of several species are now commonly grown for the purpose of making early spring-tarts. and, from their succulence and mild acidity, they form very agreeable forerunners of our earliest fruits.

(1832.) The numerous species of dock and sorrel are sometimes included in a single genus (*Rumex*), and sometimes distributed into two or three genera or subgeneric groups, viz. *Oxyria*, the mountain-sorrel, *Acetosa*, the common sorrel, and *Lapathum* or *Rumex*, the dock.

(1833.) *Rumex* is a word of doubtful origin; by some etymologists it is thought to own a common root with *rumen* and *ruma*, whence the adjective terms *ruminal*, fig-tree, and *ruminating*, beasts; and such a signification would be descriptive of many of the species which yield indifferent fodder, and of a few that abound in acid juices, which, when sucked, alleviate thirst.

(1834.) The docks are slightly purgative, and one species (*R. alpinus*), is called 'Monk's Rhubarb,' and acts like the true drug, but must be administered in larger doses. The root of *R. crispus* is said, in the form of decoction or ointment, to cure the itch; and the powdered roots of *R. obtusifolius*, from being astringent, form an excellent dentifrice. Several others have also from time to time been used in medicine, but, on account of their general inertness, they are now discarded. Indeed, *R. Patientia* seems to have been wittily named from the length of time it took to cure diseases, and the exemplary patience required in those who recovered under its administration. This, as well as *R. sanguineus* and others, have been, and still are, used on the continent as spinach, and, when mixed with the leaves of *R. acetosa*, a pleasant dish is formed. The true sorrel,

R. acetosa or *Acetosa pratensis*, has long been cultivated as a salad. It forms an agreeable and wholesome sauce with fish and other alkalescent food.

(1835.) *Oxyria*, the mountain-sorrel, is one of the most acid of the whole. It is a curious plant, so combining the characters of contiguous genera, that before it was well defined by Brown as the type of the genus *Oxyria*, it was considered a *Rheum* by Wahlenberg, and a *Rumex* by Linneus.

(1836.) *Calligonum* is interesting from the peculiar modification of its foliage, the joints giving rise to curious green excrescences instead of ordinary leaves. *C. Pallasia* is a native of Siberia, and grows in the sandy deserts bordering the Caspian Sea. The Kalmucs eat its fruit, which is acid, and fumigate their eyes when sore with the smoke of the burning stalks. The root when cut across exudes a gum analogous to gum tragacanth, a small quantity of which forms a very thick mucilage with water.

(1837.) The *Eriogona* are handsome plants, but are chiefly remarkable as being on the confines of the group, and deviating from the general characters of the *Polygonaceæ*, by having the joints thickly set with a silky or woolly production instead of ocreate stipules. Here likewise the albumen is scanty, as if in anticipation of its absence in the following groups.

(1838.) The beautiful *Begonia* has usually been included among the *Polygonaceæ*, or referred to their immediate vicinity. Bonpland has made it the type of a separate group, the location of which is, however, as undecided as was that of the genus. The *Begoniaceæ* have many characters in common with the Polygonaceæ, and were it not for their inferior germen, straight embryo, and fleshy albumen, they might be included in the same section. Bartling suggests a relationship with the *Cucurbitaceæ*, to the neighbourhood of which they cannot however with propriety be referred. Until their affinities are more clearly made out it may be most convenient to leave them near the *Polygonaceæ*, with which they agree in qualities and habit, although not to include them in the same section, for it must be confessed that if attached to the *Rumicinæ*, they could not but be regarded as a non-conforming type, notwithstanding their similitude is great.

EUPHORBINÆ.

(1839.) *Euphorbus*, physician to Juba, king of Mauritania, has received a greater reward than that which his sovereign so liberally bestowed, by having had dedicated to his memory a large and important genus, one species of which, *Euphorbia antiquorum*, he was the first to use successfully in medicine. The *Euphorbiæ* and their immediate associates, which are not more intimately allied by their organs of fructification than they are diversified in those of vegetation, form an extensive and very natural group of plants, comprehending from 1500 to 2000 species, which are collectively denominated the EUPHORBIACEÆ.

(1840.) Whether this large type should stand alone, or whether any, and what others, should be associated in the same section

with it, are points not irrevocably settled: and even its location among the Querneales, of which it is here considered a border group, has been by some disputed, on account of the occasional development of petals, rendering the plants on this neutral ground dichlamydeous, and well-marking the transition from this order to the next.

(1841.) The *Empetraceæ*, including *Empetrum*, the crowberry, are considered by Don as intermediate between the *Euphorbiaceæ* and the following types; and evidence is not wanting to shew that the *Begoniaceæ*, an aberrant group excluded from the *Polygonaceæ*, form a similar connecting link with those preceding. For, although in habit, in their organs of vegetation, and even in properties, the *Begonias* are evidently connected with the *Polygonaceæ*, still in their organs of fructification they depart so much from the normal characters of the *Rumicinæ*, that, as Bartling observes, even the types which bear the greatest similitude "innumeris notis ab illis recedunt." Some of these deviations from the *Polygonaceæ* are evidently approximations to the *Euphorbiaceæ*, such as the constantly diclinious flowers, the inflorescence in dichotomous cymes, the stamineous and pistilline flowers being concentrically disposed, so that, as in the mis-called compound flowers, a disk and radius may be traced. The stamens likewise are in both often monadelphous, though often free; the structure of the anthers and their dehiscence is also the same, and, notwithstanding the variance in position of the germen, it being inferior in the *Begoniaceæ* and superior in the *Euphorbiaceæ*, still its 3-fold development and central placentæ, are points of considerable importance. But furthermore, besides the fruit being capsular and 3-celled, the seeds have a fleshy albumen, the embryo is straight and axile, and the radicle turned towards the hilum.

(1842.) These considerations form therefore strong inducements to associate the *Begoniaceæ* as well as *Empetraceæ* in a common section with the *Euphorbiaceæ*, which, from the latter, as the most important and best known group, may be called the EUPHORBINÆ: for the segregation sought in the types or natural families is not the less decided by their collective distribution into sections; as sectional alliances are only formed on the more general similitude, and do not in any way lessen or impair typical distinctions.

(1843.) The *Euphorbinæ* are a- mono- or dichlamydeous Rosares, with monoclinious flowers, the perianth usually free, and imbricate in æstivation, the ovary 3-celled (rarely 2, or more), and the albumen fleshy, and including the straight axile embryo.

(1844.) BEGONIACEÆ. The *Begoniaceæ* are semi-succulent herbaceous plants, or under-shrubs, with non-lactescent juices. The stems and branches are nodoso-articulate and round, the leaves alternate, petiolate, simple, and oblique at the base, with free, deciduous, membranaceous stipules.

The flowers are monœcious, disposed in dichotomous axillary cymes, the central ones being stamineous, and those in the circumference pistilline. The bracteæ and bracteolæ are membranaceous, and the perianth coloured, the two inner sepals being smallest. The stamens are many, either free or monadelphous,

and the anthers 2-celled and extrorse, with a longitudinal dehiscence. The ovarium is inferior, formed of 3 compressed connate carpels, winged, and 3-celled, with two multiovulate trophosperms in each locule. The styles are 3, very short, and the stigmas lobed. The fruit is capsular, crowned with the marcescent perianth, and 3-celled, with dorsal wings. The dissepiments are very thin and narrow, the placentæ spongy and double, the seeds many, small, and exarillate with their transparent reticulate testæ. The albumen is fleshy, of the same shape as the seed, and the embryo with a round radicle turned towards the hilum.

Begonia discolor.

A. Branch with leaves and flowers, shewing the dichotomous inflorescence.

(*a*) Stamineous flower isolated.

(*b*) Pistilline one, both shewing the 2 smaller inner pieces of the perianth.

(*d*) Side view of pistilline flower, to shew the inferior germen with its 3 dorsal wings.

(*c*) Ditto of the fruit.

(*e*) Transverse section of fruit, to shew the 3-celled many-seeded ovary.

(*f*) A seed enlarged, to shew the striated testa.

(*g*) Section shewing the straight embryo and fleshy albumen.

(1845.) Hence, differentially considered, the *Begoniaceæ* are monochlamydeous Querneales, with simple alternate leaves, and scarious stipulæ, superior corollaceous perianth, monœcious flowers, a 3-celled 3-winged ovarium, and indefinite seeds with striated testæ: or, in fewer words, *Euphorbinæ* with inferior ovaries.

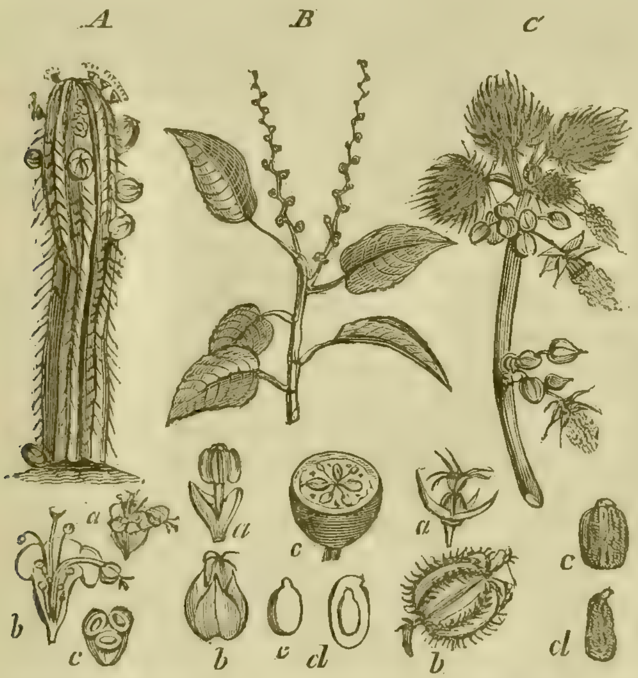
(1846.) Like the *Polygonaceæ* the *Begonias* are astringent plants, some being slightly acid, and others slightly bitter. *B. grandiflora* and *tomentosa* are employed in Peru as styptics. In Brazil the leaves of *B. cucullata, bidentata, hirtella, spathulata*, and others, are eaten when cooked as greens, under the name of *Ervo do Sapo*. The roots of *B. obliqua* are reputed to be slightly purgative, and the plant is sometimes known as 'Wild Rhubarb.' The chief value of the *Begonias* is, however, as ornamental flowers of easy culture.

(1847.) EUPHORBIACEÆ. The *Euphorbiæ* and their typical allies are trees, shrubs, or herbaceous plants, with round or irregularly angled stems and branches, and often acrid lactescent juices.

The leaves are alternate, rarely opposite, simple, with or without stipulæ, and sometimes abortive or latent in the succulent stems.

The flowers are separated, monœcious or diœcious, disposed in racemes or cymes, rarely solitary, and sometimes surrounded by an involucrum.

The perianth is either double, single, or wanting. The calyx, when present, lobed and free, beset internally with various glandular or scaly appendages, the petals when developed, alternate with the lobes of the calyx, and equal to them in number, rarely more. The stamina are definite or indefinite, the filaments free or monadelphous, the anthers exappendiculate and 2-celled, with a longitudinal dehiscence. The germens free, formed of (seldom 2, or more than) 3 carpels, connected by a central axis, and either sessile or pedate. The styles when developed equal in number to the carpels, and either free or connate, and the stigmata distinct or lobed.



A *Euphorbia officinarum.* (*a*) Capitulum of flowers. (*b*) Ditto opened, to shew the pedicelled pistilline flower in the centre, surrounded by a whorl of stamineous ones. (*c*) Section of the 3-celled fruit.

B. *Hippomane Mancinella.* (*a*) Stamineous flower. (*b*) Pistilline one. (*c*) Transverse section of the fruit. (*d*) Section of the seed, shewing the straight embryo included within the albumen. (*e*) The embryo isolated.

C. *Ricinus communis.* (*a*) A pistilline flower shewing perianth, germen, styles, and stigmata. (*b*) The fruit. (*c, d*) Front and side views of the seed, shewing its caruncle.

The fruit consists of 2-3 or more dry cocca, dehiscing elastically and separating from their common axis. The cells are 1-2-seeded, the seeds pendulous and carunculate, the albumen oily and fleshy. The embryo straight, axile, included within the albumen, the cotyledons flat and foliaceous, and the radicle superior.

(1848.) Hence, differentially considered, the *Euphorbiaceæ* are lactescent

Euphorbinæ, with variable perianths, definite pendulous seeds, caruneulate testæ, oily albumen, flat cotyledons, and superior radicle.

(1849.) The spurge (*Euphorbia*), the nettle-spurge (*Acalypha*), the manchineel (*Hippomane*), the castor oil-plant (*Ricinus*), the xylophyl (*Phyllanthus*), and the box (*Buxus*), with their numerous respective allies included in this extensive group, are distributable into 2 or 6 subtypes: the *Euphorbidæ* and *Buxidæ*. These two, which are most distinctly characterized, are again divisible, the former into four, the latter into two conventional groups.

(1850.) The *Euphorbidæ* include all the uniovulate Euphorbiaceæ.

Some of which, like the *Euphorbia*, have the flowers monœcious, apetalous, and involucrate; these are called the *Euphorbeæ*.

Others, like the *Manchineel*, have the flowers apetalous, spicate, with large bracteæ, and the stamens definite; these are called the *Hippomaneæ*.

Others, like the *Acalyphæ*, have the flowers apetalous, subracemose, or in crowded spikes, and the stamina either definite or indefinite; these are called the *Acalypheæ*.

Others, like the *Castor oil-plant*, have the flowers often corollaceous, collected into panicles, racemes, or spikes, and the stamina either definite or indefinite; these are called the *Ricineæ*.

(1851.) The *Buxidæ* include all the 2-seeded *Euphorbiaceæ*.

Of which some, like the *Phyllanthi*, have the stamina definite, and arising from the centre of the flower, the inflorescence being in tufts, fascicles, or subsolitary; these are called the *Phyllantheæ*.

While others, like the *Box*, have the stamina definite and arising from below the rudiment of an abortive pistil; these are called the *Buxeæ*.

(1852.) These minor divisions are occasionally useful, but their characters are sometimes doubtful, and the subtypes, which are easily determinable, are sufficient for all ordinary purposes.

(1853.) *Euphorbidæ*. The structure of *Euphorbia*, the typical genus of this group, was long very much misunderstood, and it is as it were but yesterday that a rational account of its organs of fructification has been given. Formerly the flowers were supposed to be united, and, from the number arranged in a radius round the pistil, situated in the disk, the genus was referred to the eleventh class in the Linnean artificial scheme (Dodecandria), while other plants closely connected with the Euphorbiæ were known to have separated flowers, some belonging to the class Monœcia and some to Diœcia, as Croton, Mercurialis, &c.

Jussieu indeed was far from being satisfied with the ordinary explication of the flowers of the *Euphorbiæ*; but it was reserved for Dr. Brown to prove that what had been mistaken for a single monoclinious flower is, in truth, like the miscalled compound flowers, a collection of twelve or more monandrous naked florets, arranged in a radius or circumference, and surrounding a single tripistilliferous central flower, which forms the disk. The inflorescence being in some measure analogous to that of *Begonia* with the disposition reversed, for there the discal flowers are stamineous and the radial ones pistilline, representing the capitula of the compositæ, in the order Polygamia Necessaria of the class Syngenesia, of Linneus.

In the Euphorbiæ the involucra are so highly developed, that neither calyx nor corolla are evolved; their rudiments may, however, be sometimes traced at the

articulation of the stamens with their pedicels; and, notwithstanding the abortion of perianth, nectaries are present in the form of lobulated or beautifully crescent-shaped glands, alternating with the lobes of the involucrum. In contingent genera they are one or both present; so that it would, to a fanciful imagination, seem as if nature had purposely developed the involucra in excess, as a mean of suppressing the calyx and corolla, and thus establishing more strongly by this transitional group the connexion of the present with the succeeding order. For here in the same type are found both apetalous and polypetalous plants, nay, even di- mono- and a- chlamydeous genera.

This metastatic development causing the suppression of certain organs by the exuberant production of others, is still further exemplified in the genus Euphorbia; for as in *E. Characias, Helioscopia,* and *Amygdaloides,* the floral integuments abort from the excessive evolution of the involucra, so in others, as the torch-weeds (*E. officinarum, enneagona, polygona,* &c.,) the entire foliage becomes latent in an enlarged and succulent stem; and the stipules, instead of being foliaceous, are reduced to the state of prickles. These changes are extraordinary, and as occurring in different species of the same genus it would be an interesting task, but the digression would here be out of place, to trace the gradual wane of the leaves from the most foliaceous, to the utterly aphyllous species.

(1854.) *Euphorbidæ.* Upwards of 200 species of Euphorbia are enumerated in Sprengel's catalogue, but, according to Merat and Lens, the genus includes about 400. Many of them are grotesque and curious looking plants, well worthy cultivation, at least for their strange appearance, if not for their beauty. They are all lactescent, and their milky sap, which contains more or less caoutchouc, is so acrid that it will redden or even blister the skin, and is used to destroy callosities, whence many species are called 'wart-worts.' Dioscorides states that in old practice this juice was dropped into the eye to remove opacity of the cornea, and also into wounds to destroy the venom of the scorpion. It is purgative and emetic, if taken internally in small doses, and the concrete juices of several species form the gum resin of medicine called '*Euphorbium.*'

The seeds yield a purgative oil, and all parts of the plants possess acrid and active properties, similar to those of the sap, but they are perhaps most powerfully concentrated in the roots of the succulent and perennial species; and especially in those which are the natives of warm countries. In Africa and Asia the leafless euphorbiæ are often planted as hedges, and most protective fences they form, their sturdy stems, prickly branches, and acrid juices, almost defying the passage of man or beast. During the wars in Hindostan such hedges were more feared by our troops than *chevaux de frise,* for soldiers not only got their flesh torn, but the wounds were filled with the burning sap; and when cavalry regiments were forced through them, the horses became ungovernable.

A species of Cacalia (C. anti-euphorbium), enjoys the reputation of being able to remove the untoward effects which follow the internal administration of euphorbium, or the irritation consequent on its external use.

(1855.) *Euphorbium* is principally obtained from three species, viz. *E. officinarum, E. Canariensis,* and *E. antiquorum,* the latter of which alone was supposed by the ancients to yield their drug. This gum resin is useful as a rubefacient to assist the action of cantharides.

(1856.) The sap of E. capitata is esteemed in Brazil as an application to serpent wounds, and that of our indigenous *E. Helioscopia*, and other species, is also used by the peasants as a caustic for the bites of vipers. In India, the sap of E. capitata is applied to apthous eruptions.

(1857.) E. *corollata* and *Cyparissias* are both emetic and purgative: the former is used in North America to evacuate the collected fluids in dropsies; and the powder of its root is said by Drs. Kean and Coxe to be a very serviceable medicine, and that of the latter, in doses of 8-15 or 20 grains, will produce very copious evacuations. In some of the French provinces it is called "*rhubarbe des pauvres*," for which drug, however, it is a miserable substitute, for La Motte mentions a case in which a woman was killed by its administration. When eaten in any quantity, it is poisonous to sheep and other animals, as is also *E. genistoides*, the feeding upon which is often followed by a fatal dysury.

(1858.) *E. heptagona*, an Ethiopic species, is a violent poison, and its juice is said to be used by the Africans to anoint their arrows and spears, so as to render the wounds inflicted mortal.

(1759.) *E. ophthalmica* has received its name from the employment of its juice, perhaps on the same principle, although unconsciously, by the natives in Rio Janeiro, as the lunar caustic unguent has been so successfully used here in the treatment of ophthalmia.

(1860.) Some of the less acrid *Euphorbiæ*, as *Peplus* and *Lathyris*, might, if other cathartics failed, be safely used. The former is said to act without producing nausea, and the latter is frequently taken on the continent, the dose being from 12-15 of its seeds. The cathartic properties of the seeds reside in an oil which is abundant in their fleshy albumen, and which, when expressed, exhibits the same qualities as the entire seeds, but in a more concentrated form, the dose being from 4-8 drops: so that it might become a cheap substitute for the oil of the *Croton Tiglium*. The seeds yield from 44-52 per cent. of this purgative oil, and, according to Merat and Lens, it may be prepared at so moderate an expense that enough might be bought for five sous to cleanse the *primæ viæ* of about 100 patients. Notwithstanding their acridity the seeds of *E. Lathyris* are not unfrequently pickled instead of capers, and eaten as a sauce with meat, whence it has been called the caper-spurge. Such diet can scarcely be considered safe or wholesome, although the process of pickling will lessen, and perhaps may remove, the more active principles: indeed, the ancients were accustomed to steep the *Euphorbiæ* in vinegar, and to expose them to heat, in order to moderate their acrimony.

(1861.) *E. dulcis* and *edulis* are less acrid than most of their allies, and in Cochin-china the leaves of the latter are dressed and eaten with other green vegetables; and we are told that formerly it was the practice to mix the leaves of *Euphorbiæ* with common potherbs, in order to render them cathartic, and thus to take physic and food together.

(1862.) The slipper-spurge, *Pedilanthus padifolius*, is used in the West Indies as an emetic, and its root, which is given in doses of 12-15 grains, is called St. Domingo ipecacuanha.

(1863.) *Hippomaneæ.* The Hippomane of the Greeks was an Arcadian plant, said to have the power of making horses mad. It was not improbably a species of *Euphorbia*, the acrid juices of which, flowing into the wounds inflicted by the

thorns would render most beasts outrageous, and therefore must not be mistaken for the poisonous distillation from raging mares, as described by Virgil, in his third Georgic.

(1864.) The modern *Hippomane* is the *manchineel tree*, a very acrid and deleterious plant, but the poisonous properties of which have been much exaggerated. Jacquin and Ricord have shewn that the notion formerly prevalent of the shade or *exhalations* from the tree being deleterious, is untrue, for they remained under its shadow for several hours, and even passed through extensive forests of manchineel trees without being injured. The sap which exudes when the boughs are cut or broken, is, however, very acrid; it will blister and sphacelate the skin, and, if inserted into wounds, cause death. The timber is beautifully variegated with brown and white, and capable of receiving a high polish; but before the trees are felled fires are usually lighted round them, to inspissate the sap, and render the hewer's occupation less dangerous; for, even when the juices are not applied in sufficient quantities to produce death, they cause intense pain, likened to the burning of a red-hot iron. This led to the cruel practice mentioned by Merat and Lens, as having prevailed in the French colonies, of the slave-drivers steeping their scourges in manchineel juice before they flogged the negroes. When such enormities are perpetrated by the masters the sequel cannot excite surprise; for further on, we are told that the poisonous juice and fruit of the manchineel have been mixed by the slaves in coffee to release themselves from their oppressors. M. Ricord states, from much experience, that the usual antidotes against this poison are ineffectual, and that the only remedy he found of use was an emulsion made from the seeds of the Nhandirhoba, (*Feuillæa scandens*), and, when the dose of *manchineel* had not been very large, this lessened and removed its effects.

(1865.) The fruit of the manchineel is very poisonous, at least to warm-blooded animals. Travellers affirm that those seeds which fall into the sea are eaten by fish with impunity, and that land-crabs gather round the trees in vast numbers to feed upon them; and that although not destroyed themselves, their flesh is injurious to man. Jacquin, however, suspects the truth of the relation, and probably the belief of *crabs* eating the fruit, may have arisen from its being used by the negroes to cure a troublesome tumour on the foot to which they are subject, and which by the French colonists has been called *le crabe*.

(1866.) *Excæcaria* is another very poisonous genus; its juices are so acrid, that if applied to the eyes they cause blindness, whence its name. Even the smoke of *E. agallocha*, which affords one of the *aloe-woods*, will produce very serious injury. Rumphius relates, that some sailors sent on shore to cut wood accidentally rubbed their eyes when their hands were wetted with its sap, became blind, and ran about distracted like madmen.

(1867.) *Hura crepitans* is the *sand-box*, or *monkey's dinner-bell*, as it is sometimes called, from the noise which is made by the elastic dehiscence of its capsules. The seeds of this plant, although acrid and injurious to man, are said to be less so, or not at all, to certain animals, as for example to dogs and monkies, who, by the cracking of the capsules, are summoned to their repast. Its sap contains, like that of the *Excæcariæ* and other *Euphorbiaceæ*, caoutchouc, and is very acrid.

(1868.) The tallow tree of China is a species of *Stillingia*, named after the celebrated *Stillingfleet*. The oil expressed from the seeds of *S. sebifera* hardens

on exposure to cold, to the consistence of suet or common tallow, and, by boiling, it becomes as hard as bees'-wax.

(1869.) The seeds of *Omphalea diandra* and *triandra* are eatable by man; in Guiana and St. Domingo they are substituted for nuts. A useful oil is also extracted from them, and the sap of the stem yields caoutchouc.

(1870.) *Commia Cochinchinensis* yields a white tenacious gum-resin that is both emetic and cathartic, and which is said to be useful, when cautiously administered, in dropsy. *Sapium aucuparium* is reputed to be so poisonous, that its fumes alone will cause swelling of the nostrils and severe erysipelas. But *Maprounea Brasiliensis*, although an immediate ally of *Sapium* and *Hippomane*, is an admirable stomachic. It is however devoid of the milky sap common to the poisonous species. It affords a black dye, not of much value, on account of its fugitiveness.

(1871.) *Acalypheæ*. The nettle-spurges (*Acalyphæ*), are plants of no beauty, and of little use. *A. indica* is said to be anthelmintic, and the leaves, when rubbed on the tongues of children, excite vomiting. *A. betulina* is mentioned by Ainslie as an agreeable stomachic in cases of dyspepsia; it is also one of the many Indian remedies for cholera.

(1872.) *Plukenetia volubilis*, the Sajor baguala of Rheede, is another of the less virulent *Euphorbiaceæ*. In India the plant is cultivated as an esculent vegetable, and its leaves, boiled in cocoa-milk, are said to form a delicate and agreeable food. According to De Candolle its sap affords caoutchouc. In Amboyna the leaves of *P. corniculata* are eaten as potherbs. This genus commemorates Leonard Plukenet, author of "Almagestum," and "Amaltheum," works of singular merit, notwithstanding the pompous titles with which they are encumbered.

(1873.) The dog's mercury is a very poisonous plant both to men and brute animals. Sheep, when turned into woods, often suffer from it; and serious accidents have happened from its being mistaken for *Chenopodia* and other potherbs. (Vide Med. Bot. lxxviii.) It is reported in many botanical works to be eatable when boiled. This is, however, an error, probably arising from its being mistaken for M. annua, or confounded with a species of *Theligonum*, formerly named, like it, *Cynocrambe*. The leaves on drying become of a blue colour, shewing its affinity to *Crozophora* (*Croton*) *tinctoria*, and from them a kind of indigo may be procured.

(1874.) *Mercurialis annua* is less deleterious than the preceding species; indeed, it so much abounds in mucilage, that, when boiled, it is eaten in some parts of Germany as spinach; the water in which it has been cooked is, however, rendered cathartic and diuretic, and has been used medicinally. It was formerly received into our Materia Medica, and esteemed as an emmenagogue. Linneus also speaks of it as an anodyne. This species, which is diœcious, is peculiarly interesting from the irritability of its flowers, the stamineous ones becoming loosened from their foot-stalks when mature, and vaulting elastically to the neighbouring pistilline plants:—a fact, I believe, first noticed by myself last summer.

(1875.) One species of *Caturus*, according to Burmann, *C. spiciflorus*, is esteemed in India as a specific in diarrhœa, and also as an agreeable tonic. The flowers are the parts used, either made into a conserve or taken in decoction. Tragia involucrata is considered an alterative, and thought to be useful in cachectic complaints.

(1876.) *Ricineæ*. The Palma Christi is a well-known plant, a favorite in gardens, on account of its splendid foliage and handsome inflorescence, and still

more familiar, from being the source of castor-oil. The properties of the *Ricinus* appear to claim for it an intermediate rank between the Crotons and Elæococci; the *Oleum Ricini* being more active than the oils of the latter, and far inferior in energy to those of the former, which are in some instances so concentrated as almost to deserve to be considered poisons.

(1877.) The *Elæococcus verrucosus* (Dryandra oleifera of Thunberg), yields oil so abundantly by expression from its seeds, that in the Isle of France it is commonly used to burn in lamps; and in Japan, although a little hot, it is employed in cookery. *E. Vernicia* is equally prolific of oil, but, on account of its greater acridity, it is fit only for lights or painting.

(1878.) Of the Crotons, *Tiglium*, *Cascarilla*, *Eleuteria*, and *gratissimus*, are the most important species. The oil procured from the seeds of the first named is one of the most powerful cathartics known; a quarter of a drop is a full dose for many persons, and a whole drop, when genuine, has been known to produce hypercatharsis. It is a valuable medicine in cases of apoplexy, paralysis, and mania; for a single drop placed on the tongue, or a few drops rubbed in over the abdomen, will often evacuate the bowels when ordinary medicines cannot be administered, or have failed.

(1879.) The Cascarilla bark of medicine is the produce of the *C. Eleuteria*, *C. Cascarilla*, and probably of some species of *Cluytia*. It is an agreeable aromatic bitter, and deservedly popular as a tonic. *C. gratissimus* is so fragrant, that its leaves are gathered by the Koras of the Cape of Good Hope as a perfume; and both *C. fragrans* and *C. fragilis* are odoriferous. *C. Perdicipes*, *antisyphiliticus*, *campestris*, and others, are alterative and diuretic, and are considered in warm countries as surrogates for mercury. *C. hibiscifolius* yields a red juice, which, when concrete, resembles dragon's blood.

(1880.) *Crozophora* (the old Croton) *tinctoria* affords the *Turnsol*, which is a coloured juice excreted from the fruit, and with which rags are wetted for exportation. When wanted for use, the stained cloths are steeped in water, and jellies and other things coloured.

(1881.) *Aleurites laccifera* is one of the plants from which gum lac is collected. The Bancoul or Molucca nuts are the fruit of A. ambinux. They are esculent but heavy, and not easily digested.

(1882.) *Codiæum* (olim Croton) *variegatum* is a plant celebrated for the beauty of its foliage; branches are used by the native Africans as ornaments in their fêtes, and also at their funerals. Its root and bark are acrid and cathartic, but its leaves are mild, and are said to be eaten when young in soup.

(1883.) *Anda Braziliensis* is the *Andaà-Cu* of the native Americans, with which they poison or rather intoxicate fish, to snare them. Its bark abounds with a deleterious sap, and of this the stupifying decoction is made. The seeds are cathartic, and have time out of mind been used in Brazil in cases of indigestion, liver complaints, jaundice, dropsy, and more diseases than it falls to the lot of any one medicine to be able to cure. The albumen is very oily; and the oil, when expressed, is used by the Indians to anoint their bodies, and by European settlers to burn, and for painting: it is too active to be employed as food.

(1884.) The *Hyæna poison* is the fruit of *Hyænanche globosa*, a small Euphorbiaceous plant growing at the Cape of Good Hope. The seeds, when powdered, are used by the natives and colonists to envenom the carcasses of lambs; and so noxious are they, that the bait when eaten infallibly destroys the hyæna.

(1885.) *Jatropha* is an important genus; its very name (ιατρον φαγω), an eatable medicine, or food and physic, implies its value. One species, *J. Manihot,* affords the celebrated manioc or magnioc of the negroes, known however better as the cassava of the West Indies, and the tapioca of Brazil. This very mild, innoxious, and nutritious food, is remarkable for being the produce of the root of the Manihoc which, when in its fresh state, is highly poisonous; the juice, with which it abounds, would form a deadly draught, and is even used by the savages to envenom their spears and darts. The deleterious principle is very volatile, passing off from the roots after they have been kept for thirty-six hours, and immediately dissipated by heat. It may be obtained by distillation, and destroys life in birds and quadrupeds with symptoms similar to those produced by prussic acid, but that principle has not been detected, although, according to M. Soubeirain, it smells like bitter almonds. Dr. Fermin says that half a teaspoonful killed a large dog in five minutes, and a slave condemned to death was destroyed in six minutes by the administration of thirty-five drops.

Two ounces of *Cassava* will suffice for a meal, and a pound will support a man for twenty-four hours.

(1886.) The physic-nuts of South America and the West Indies are the seeds of the *Jatrophæ,* especially of *Jatropha Curcas;* but those of *multifida,* &c. are cathartic likewise. The oil expressed from the seeds is very active if taken internally, and, with that of *J. glauca,* is considered a good external application in cutaneous diseases, and as a stimulating embrocation in chronic rheumatism. The Chinese make a varnish for their ornamental works, by boiling the oil of *J. Curcas* with oxide of iron.

(1887.) *J. elastica* (Siphonia vel Hevea elastica), is commonly referred to as one of the chief sources of caoutchouc, the *Cahuchu* of the natives; but this valuable substance is found in the milky saps of a variety of other Euphorbiaceous plants, as well as in the lactescent *Artocarpaceæ,* which thus establish a connexion with the present group.

(1888.) *Buxidæ.* This is a much smaller subtype than the preceding, and contains plants of much less general importance.

(1889.) *Phyllantheæ.* The *Phyllanthi* have the same general properties as the other plants in this type. They are active, but vary in their acridity and stupifying powers. *P. Brasiliensis* (Conami) and *P. virosus* are used in Guiana to intoxicate fish, the roots or bark being bruised and cast into the water. *P. Niruri, multiflorus,* and *maderaspatensis,* are used medicinally by the Wittens of Hindustan, who consider them tonic as well as diuretic. *P. urinarius* is one of the most powerful. *P. microphyllus* is said to have been serviceable in diabetes. The leaves of *P. rhamnoides* are also esteemed as a poultice for carbuncles.

(1890.) The *Ciccæ* afford eatable fruits, known as Indian cherries; they are cooling and refreshing, but the seeds are cathartic; and the leaves, which contain an acrid sap, are both purgative and emetic: when made into a decoction, they are a powerful sudorific.

(1891.) *Cluytia collina* is a poisonous plant, and Cluytia, now *Brodelia spinosa,* astringent and anthelmintic. It is used in India to destroy intestinal worms in cattle; and it is said that beasts will greedily devour it to rid themselves of the parasites.

(1892.) *Buxeæ.* The roots of *Fluggea Leucopyrus* are esteemed in Coromandel as an astringent: its fruit is also succulent, and is eaten by the poorer people. The fruit of Drypetes is acrid, and inflames the throat when swallowed;

and the leaves of the common box are deleterious to all animals that feed upon them except the porcupine. Camels are said to be fond of them, but if allowed to eat them they perish. Box-leaves are reputed to possess sudorific powers, and, made into a tincture, they formed a once celebrated specific for intermittent fevers. The remedy was kept secret by a German empiric until purchased by Joseph II. for 1500 florins, since when it has fallen into disuse. The box is a very tonsile tree ; and is a favorite for hedges, formal figures, and edgings. In the entertaining letters of Pliny the Younger, we read that he had at his country-seat box-trees cut into the form of men on horseback, a hunter preceded by the hounds, various other quadrupeds, elegant vases, &c., and that one box-tree was of such vast dimensions as to be cut into different apartments, in the centre of which was a verdant saloon with marble benches, an aquarium, waterfall, &c. The wood is now of more value than any other part. It is firm, hard, smooth, and heavy; hence well fitted for the nicer kinds of turnery. Mathematical instruments are generally made of box-wood; combs, chessmen, weaver's shuttles, &c. are turned from Levantine or American box, which for most purposes is preferred to that of English growth; but neither of them are equal to the English for wood-engravings, which, since the modern improvements in the art, and the plan of cutting on the end of the block instead of the lengthway of the grain, is the most important purpose to which it is applied.

Empetrum nigrum.

A. Entire plant, shewing its heath-like habit, simple acerose leaves, and fruit.

(*a*) Stamineous flower.

(*b*) Pistilline ditto, shewing the single perianth.

(*c*) The fruit opened to shew the several cells.

(*d*) A seed removed.

(1893.) Empetraceæ. *Empetrum*, the crowberry, formerly confounded with the Ericeæ, on account of its heath-like habit, has been made typical of a small and not very important group, containing only *Empetrum*, *Corema*, and *Ceratiola*, which is called from the former the *Empetraceæ*.

(1894.) The *Empetraceæ* are small heath-like shrubs, with minute alternate or subimbricate leaves without stipulæ, and acrid aqueous juices.

The flowers are axillary, small and separated, the perianth is single, 3-cleft, and persistent, its scale-like sepals being imbricated in æstivation. The stamens are definite (3), the filaments long and free, the anthers 2-celled and bursting length-

wise. The superior germen consists of 3 connate carpels or a multiple of 3, being 3-9-celled; the cells are uniovulate, and the solitary ovules erect. The stigmata are simple, equal in number to the cells of the ovarium, patent and stellate. The fruit is fleshy, enclosed within the persistent perianth, 3-9-celled, and the sides of the cells horny. The seeds are solitary, ascending, and without carunculæ; the albumen is fleshy and watery, the embryo is axile, taper, erect, and enclosed within the albumen.

(1895.) Hence, differentially considered, the *Empetraceæ* are non-lactescent *Euphorbinæ*, with superior ovaries, ascending seeds, and watery albumen.

(1896.) *Empetrum*, so named from its growing (*εν πετρος*) among stones, is a very common plant. *E. album* is found in the south, and *E. nigrum* in the northern parts of Europe. In the Highlands of Scotland children eat the berries, but they are no very desirable dessert, and are said to produce headach if taken in large quantities. Gmelin says that in Siberia an acid drink not unlike lemonade is made from them, and the Kamtschatdales not only eat them with their fish and make them into puddings with lily-bulbs, but also dye their clothes of a good black colour with their juice. Otter and sable skins are said to be dyed black with crowberries. Mr. Neill tells us that he saw at Deerness, in Orkney, very strong ropes, well calculated for different purposes in rural economy, made from the shoots of the crow- or crake-berry.

[§ 1743.]
Piper nigrum.

A. Branch shewing leaves and fruit in different stages of growth.

(*a*) Portion of inflorescence with flowers enlarged.

(*b*) Longitudinal section of the fruit.

(*c*) Transverse ditto.

(*d*) Embryo.

(1897.) Although the *Euphorbinæ*, both through the structure of the *Empetraceæ*, as well as by the corollaceous genera of the *Euphorbiaceæ*, are so intimately connected with the following types, that they have sometimes been arranged in the same section and order with them, this alliance does not seem, on examination, to be more intimate than that established between other orders; and hence, notwithstanding the admission that no absolute line of demarcation can be drawn, it will be expedient to close the account of this order with a synopsis of

the sections and types it comprehends, similar to those which have concluded the histories of the preceding orders.

(1898.) Conspective summary of the sections, types, and subtypes, included in the order QUERNEALES.

Order.	Sections.	Types.	Subtypes.
QUERNEALES (1502—8)	EUPHORBINÆ (1843)	*Empetraceæ* (1894-5) *Euphorbiaceæ* (1847-8) *Begoniaceæ* (1844-5)	*Buxidæ* (1851) *Buxeæ* (B) *Phyllantheæ* (A) *Euphorbidæ* (1850) *Ricinæ* (D) *Acalypheæ* (C) *Hippomaneæ* (B) *Euphorbeæ* (A)
	RUMICINÆ (1775)	*Polygonaceæ* (1820-1) *Nyctaginaceæ* (1814-5)	
		Scleranthaceæ (1807-8)	*Illecebridæ* (1811) *Pollichidæ* (1812) *Scleranthidæ* (1810)
		Betaceæ (1786-7)	*Amarantidæ* (1789) *Chenopodidæ* (1788)
		Petiveriaceæ (1777-8)	*Phytolaccidæ* (1781) *Petiveridæ* (1780)
	ASARINÆ (1756)	*Nepenthaceæ* (1765-6) *Aristolochiaceæ* (1757-8)	*Asaridæ* (1761) *Aristolochidæ* (1760)
	PIPERINÆ (1739)	*Chloranthaceæ* (1751-2) *Piperaceæ* (1743-4) *Saururaceæ* (1740-1)	
	HIPPURINÆ (1720)	*Ceratophyllaceæ* (1734-5) *Trapaceæ* (1730-1) *Hippuridaceæ* (1722-3)	*Haloragidæ* (1725) *Callitrichidæ* (1726) *Hippuridæ* (1727)
	LAURINÆ (1662)	*Terminaliaceæ* (1716-7) *Santalaceæ* (1706-7) *Penæaceæ* (1701-2) *Proteaceæ* (1697-8)	*Santalidæ* (1711) *Nyssidæ* (1710) *Osyridæ* (1709)
		Thymelæaceæ (1688-9)	*Thymelidæ* (1691) *Elæagnidæ* (1692)
		Hernandiaceæ (1684-5) *Myristicaceæ* (1676-7) *Lauraceæ* (1663-4)	*Cassythidæ* (1667) *Lauridæ* (1666)
	URTICINÆ (1585)	*Monimiaceæ* (1655-6)	*Atherospermidæ* (1659) *Amboridæ* (1658)
		Datiscaceæ (1652-3)	
		Urticaceæ (1631-2)	*Lacistemidæ* (1636) *Cannabidæ* (1635) *Urticidæ* (1634)
		Platanaceæ (1591-2) *Stilaginaceæ* (1587-8)	*Antiaridæ* (1596) *Artocarpidæ* (1595) *Platanidæ* (1594)
	ULMINÆ (1572)	*Aquilariaceæ* (1581-2) *Chailletiaceæ* (1578-9) *Ulmaceæ* (1573-4)	
	QUERCINÆ (1510)	*Juglandaceæ* (1564-5) *Corylaceæ* (1541-2)	*Coryllianæ* (1540)
		Betulaceæ (1534-5) *Salicaceæ* (1522-3) *Myricaceæ* (1518-9) *Casuarinaceæ* (1513-4)	*Betulianæ* (1540)

ROSALES.

(1899.) The second order of the *Cressels* or *Rosares* includes all those exogenous angiospermous plants in which the floral integuments are double, and in which the petals of the corolla remain distinct.

Hence the *Rosales*, differentially considered, are *apopetalous dichlamydeous Rosares.*

They are thus generally distinguished from the *Querneales*, which are apetalous, and either mono- or a-chlamydeous; as well as from the following order, the *Syringales*, in which, though the flowers consist of two whorls of metamorphosed leaves, a calyx and corolla, the petals of the latter are united.

(1900.) The above definition is not, however, a universal rule; for sometimes the corolla is abortive, and sometimes the calyx is nearly obsolete: but these are rare exceptions, both, in general, being present and well developed. The petals likewise, which are normally discrete, occasionally shew a tendency to cohere by their edges; a deviation indicative of the state to be perfected in the succeeding grade.

(1901.) The types and sections arranged in this present order were distributed by Jussieu among his 12th, 13th, and 14th classes, and systematically described as having the stamina epigynous, hypogynous, and perigynous, respectively. Richard and De Candolle, without much varying the Jussieuan classes, or even disturbing the consecutive arrangement of the orders, have imposed names expressive of their characters upon each, so that they are more conveniently referred to than by their simple numerical designations. Thus the polypetalous plants with hypogynous stamens, forming the 13th class of Jussieu, are called *hypopetalæ* by Richard, and *thalamifloræ* by De Candolle; and the *calycifloræ* of the last named botanist include the 12th and 14th classes of the former, which are denominated *epipetalæ* and *peripetalæ*, by Richard.

(1902.) It might seem that these characters, which are tolerably constant, should form excellent analytic as well as synthetic signs. But it is found that if adhered to strictly, so as to become serviceable as an index, many plants are irreducible without separating them from others with which they are intimately connected, and near which they should be arranged in a natural system. Hence, some of the highest authorities have abandoned the subdivision of the Polypetalous Rosares into the Jussieuan classes, and at once resolved them into those smaller groups of genera, called types or families. But these, which in the time of Jussieu amounted only to 37, two being included in his 12th, twenty-two in his 13th, and thirteen in his 14th class, have by recent discoveries and modern refinements been so multiplied, that now their number considerably exceeds a hundred. This series, more extensive than that into which the whole vegetable

kingdom was divided by Jussieu, and containing three times the number of orders indicated by Linneus, imperatively demands subordinate association; and it will be found that the numerous types, or natural groups of genera, may be collected into a few districts or sections; and these, although their number is not great, it seems expedient to arrange in two or three sub-orders, equivalent to the *Thalamifloræ* and *Calycifloræ* of De Candolle, or the Epi- Peri- and Hypo-petalæ of Jussieu. For, as before explained, the anomalies (?) which are grave objections to such grouping when given as a system of analysis, cease to be such when it is regarded only as a synthetic scheme, and especially when another, an artificial one, is adopted as an index.

(1903.) The sections included in the order *Rosales*, and which are themselves formed of associated types and genera, are distributable, and appear to be most advantageously distributed, into three sub-orders; and, as these are equivalent, or nearly so, to those already mentioned as having been devised by Jussieu, and in part adopted by De Candolle, the names devised by Richard may be retained, at least as synonymes of *Myrtosæ*, *Angelicosæ*, and *Rhæadosæ*, the terms here employed, or of any others that have been or may be imposed.

(1904.) These intermediate groups between orders and sections, although not essential, are convenient grades; and hence, notwithstanding their abandonment by some modern writers, they are, with certain modifications, introduced into these outlines, from a conviction of their utility, and a firm belief that they render comparatively easy the course of an otherwise somewhat complex investigation. And therefore, even were such subdivisions less natural than they really are, it would be expedient to retain them, and especially here, at least as conventional demarcations of a most extensive order, which is remarkable, not only for the number, but also for the importance of the plants it comprehends.

(1905.) The *Barberry*, the *Ranunculus*, the *Water-lily*, and the *Poppy*; the *Rock-rose*, the *Carnation*, *Geraniums*, *Mallows*, *Hypericums*, *Rues*, *Maples*, and *Vines*, are sectional examples of the numerous plants included in the sub-order Hypopetalæ or Rhæadosæ.

(1906.) The *Holly* and the *Cashew Nut*, *Pulse*, *Roses*, *Fuschias*, *Myrtles*, *Currants*, *Melons*, *Saxifrages*, and their respective allies, being peripetalous Rosales, are associated to form the sub-order Peripetalæ or Myrtosæ.

(1907.) And the *Umbelliferous plants*, including the true *Umbellinæ*, the *Aralias*, and the *Loranthinæ*, form the sub-order Epipetalæ or Angelicosæ.

(1908.) The terms *hypopetalæ*, *peripetalæ*, and *epipetalæ*, adopted from *Richard*, seem to be preferable as names of the sub-orders to those which have been invented by De Candolle; because, although the *thalamifloræ* of the latter writer are equivalent to the *hypopetalæ* of the former, the *calycifloræ* of the one includes both the *peri-* and *epi-petalous* plants of the other; which groups, not only out of respect to Jussieu, but also from regard to their structural peculiarities, it seems advisable to keep primarily distinct.

(1909.) The peripetalous and hypopetalous Rosales are closely connected both with the preceding and succeeding orders; the *Celastraceæ* of the one, and the *Menispermaceæ* of the other, being intimately allied with the *Empetraceæ* and *Euphorbiaceæ* of the Querneales; while the synsepalous and catapetalous mallows of the latter, and gourds of the former, anticipate the union of the corolla, which is the common characteristic of the Syringales. And furthermore, notwithstanding the epipetalæ are affianced to the caprifoliaceæ and the so called compound

flowers, they bear no slight similitude in their mode of inflorescence, as well as in other particulars, to the *Euphorbinæ*. Indeed, the types and sections included among the Rosales, like others already mentioned, seem to pass from the confines of the Querneales to the limits of the succeeding order, and then to return to the point from which the circuit commenced. Instances of this return of a natural group upon itself are frequent in the vegetable, as well as in the animal kingdom. Examples of it have been given in the algæ and the fungi, and others might be adduced from other classes.

(1910.) Thus the Rosales proceed from the crowberries, (or empetraceæ,) in which the corolla is occasionally developed through the *hollies* and cashews, the pulse, roses, myrtles, currants, melons, saxifrages and ivies, with their respective allies, to the Loranthaceæ, which, having both apopetalous and synpetalous corollæ, connect them with the Syringales; and then return from the confines of the succeeding order through the umbelliferæ, vines, maples, rues, mallows, pinks, rock-roses, poppy-like plants, water-lilies, ranunculi, barberries, &c. to the *Euphorbiaceæ*, with which the *Menispermaceæ* are intimately allied.

(1911.) The excursive sections are peripetalous or calyciflorous, and form the first sub-order; the returning ones are hypopetalous or thalamiflorous, and form the last sub-order; the second sub-order contains the umbelliferous plants and their epipetalous allies, which are included in the calycifloræ of De Candolle, but which seem to have been properly distinguished by Jussieu.

(1912.) Perhaps this tendency may account for the diversity of opinions that are entertained as to the sequence of the families in the natural system; for, without presuming to declare that such a return is made by nature, it may safely be affirmed that frequent indications of it are, as it were, accidentally surprised, and doubtless many more, if sought for, might be found.

(1913.) The sub-order *Myrtosæ*, or *peripetalæ*, is formed by the segregation of those sections of the Rosales in which the petals and stamens are exserted from the calyx or the disk.

But, besides the above chief differential signs, the calyx is in general synsepalous, its leaves being more or less connected with each other, especially towards the base. The torus likewise is adnate to the inside of the calyx, or to the stipe of the ovary; and hence often bears the stamens and corolla. The petals are usually free, but the ovaries are either free or adherent to the calyx.

(1914.) The torus or disk, in this sub-order, forms an admirable morphological study, as it is very varied and often betrays its origin. It is a peculiar organ, appearing to be an intermediate stage between the peduncle and floral envelopes, or perhaps rather, the floral coverings in part remaining undeveloped; hence its union with the tube of the calyx or base of the ovaries; and hence also the exsertion and apparent rise of the petals and stamens therefrom.

(1915.) The sub-order *Angelicosæ* or *epipetalæ*, is formed by the association of those few Rosales in which the stamens and petals are exserted from an epigynous disk or torus; which, instead of lining the calyx, is seated on the summit of the germen.

(1916.) The sub-order *Rhœadosæ* or *hypopetalæ* comprehends all those sections of the order Rosales in which the petals and stamens are hypogynous, and are exserted directly from the receptacle; being, as well as the torus, free from any union with the ovaries or calyx. Hence, they are readily distinguished from the two preceding groups.

MYRTOSÆ.

Peripetalæ, (Juss. and Richard,) part of Calycifloræ, (De Cand.)

(1917.) In the several types and sections of the *Querneales* in which the law of development tends to the suppression of the petals, or rather to the non-evolution of a corolla, the calyx was found occasionally to become highly coloured and petaloid, as in the Thymelidæ, and in many of the Polygonaceæ. Sometimes also degenerate stamina were observed to assume the form of petals, or petal-like scales or nectaries, to be produced within the perianth, as in *Daphne Trapa*, *Ricinus*, the *Chailletiaceæ*, and others. So likewise among the Rosales in which a whorl of petals is normally developed there are frequent tendencies observable to relapse into the former state by the abortion of the corolla; and in no sections is this tendency more common than in those which bound the apetalous province, and connect the two orders by their relationship with the *Euphorbinæ*.

Thus in *Alzatia*, one of the *Celastraceæ*, the law of superdevelopment seems to be disregarded, and even in other genera, as in *Rhamnus*, not to have become fully established, and its authority but imperfectly confirmed. In these and similar misnamed anomalies may be traced the course pursued by nature to avoid any violent or sudden change, even between the larger groups or orders, which pass into each other by a like easy and gradual transition, as the types, the genera, and the species do. They are in fact the links made visible of that mysterious chain, which insensibly connects the most distant parts, and harmonizes the diversity of the whole.

ILICINÆ OR CELASTRINÆ.

(1918.) *Celastrus*, the staff-tree; *Ilex*, the holly; and *Rhamnus*, the buckthorn; are the normal genera of three types, associated with *Brunia* and its allies, to form the present section. The *Celastrineæ*, *Ilicineæ*, and *Rhamneæ*, of modern writers, were conjoined in his *Rhamni* by Jussieu; and these, with most of their then known allies, were included in the 43d natural order of Linneus, which, from the bushy growth of the majority, he termed *Dumosæ*.

(1919.) The *Ilicinæ*, differentially considered, are peripetalous Rosales or Myrtosæ, with impunctate and mostly simple leaves, imbricate, (rarely valvate,) æstivation of the calyx, definite stamina, carpels few, generally four or less; seeds mostly albuminous, and the embryo straight.

(1920.) Aquifoliaceæ. The holly (*Ilex Aquifolium*), gives its old generic and modern specific name to the present type, which includes two subtypes, the *Stackhousidæ* and *Aquifolidæ*, so called from the respective normal genera of each.

(1921.) The *Aquifoliaceæ* are herbaceous plants or shrubs, seldom assuming the port of trees, with alternate or opposite, simple, entire leaves, often coriaceous; in the one subtype (*Stackhousidæ*), furnished with minute stipules, in the other (*Aquifolidæ*), exstipulate.

B. *Ilex Aquifolium*. Branch with leaves and fruit.

(*a*) Flower separated, to shew the 4 stamina alternate with the petals.

(*b*) Another view of a flower, to shew the calyx, corolla, and pistil, with its 4 stigmata.

(*c*) The fruit.

(*d*) Transverse section, to shew the 4 cells.

(*e*) The seed.

(*f*) Vertical section, to shew the embryo.

(*g*) Two views of the embryo isolated.

The inflorescence is axillary or terminal, and either fasciculate or solitary. The flowers are small (in the *Stackhousidæ* tribracteate), united, or by abortion polygamous. The calyx is synsepalous, 4 or 5 cleft, and imbricate in æstivation. The corolla formed of 4-5 petals, and more or less adherent by their claws, or catapetalous, and the disk is absent. The stamina are definite, free, and exserted either from the calyx or corolla.

The germen is superior, 2-6-celled, and the ovules solitary. The styles short, either free or connate, and the stigmata simple. The fruit is indehiscent, dry, or drupaceous, the seeds solitary, exalbuminous, and exarillate, with a straight axile embryo.

(1922.) Hence, differentially considered, the *Aquifoliaceæ* are catapetalous *Ilicinæ*, with an imbricate æstivation, subperigynous stamens, superior germen, and albuminous exarillate seeds.

(1923.) The two subtypes *Stackhousidæ* and *Aquifolidæ* differ in the following particulars.

(1924.) The *Stackhousidæ* are herbs with stipulate leaves, the calyx ventricose and bearing both petals and stamens, the styles lateral, the ovarium lobed, the fruit dry, and the seeds erect.

(1925.) The *Aquifolidæ* are shrubs or small trees, with exstipulate leaves, a small calyx not bearing either the petals or stamens; the corolla being hypogynous and staminiferous, the ovary truncate, the fruit fleshy, and the seeds pendulous, and nearly sessile, with a small chalaza.

(1926.) *Stackhousidæ*. The *Stackhousidæ*, which are natives of New Holland, connect, according to the views of Dr. Brown, the *Celastraceæ* with the *Euphorbiaceæ*, and are thus interesting as they corroborate the alliance which was anticipated by the *Empetreæ*. Of the properties of these plants there is at present nothing known.

(1927.) *Aquifolidæ*. The common holly, holme, or hulver, of which we have many varieties, is the only British species of Ilex. Here it seldom exceeds the size of a bush; but we have some in Needwood forest, Staffordshire, and in the woods of Dumbartonshire, which are thirty feet or more in height, and in Bretagny it becomes a tree, growing as high as fifty feet. Its prickly green leaves fit it well for hedges; and, when Dutch horticulture prevailed here, gardens were portioned out by well clipped holly-hedges. The celebrated Evelyn had one, at Says' Court, 400 feet long, nine feet high, and five feet broad, which he had planted at the suggestion of Peter the Great, who resided at his house when he worked in the dockyards at Deptford. And in his Sylva he asks with rapture, "Is there under heaven a more glorious and refreshing object of the kind than such an impregnable hedge, glittering with its armed and varnished leaves, the taller standards at orderly distances, blushing with their natural coral."

The holly is a very slow growing tree, and its timber is among the hardest of the white woods. It is much used by turners, and especially in the manufacture of Tunbridge-ware.

The liber abounds with a tenacious substance, which, when separated by bruising and maceration, is known as bird-lime.

Both the bark and leaves of holly are bitter, and have been used in the cure of intermittent fevers. From the statement of an extensive series of trials made by Dr. Rousseau of Paris, and published in the Transactions of the Medico-botanical Society of London, it appears that the powder or decoction of the holly-leaves and bark, as well as a new vegetable proximate principle extracted therefrom, called Ilicine, are equally efficacious with Quinine and Peruvian bark, and in some cases appear to be more decided and beneficial in their effects. The silver medal was awarded to Dr. Rousseau for his communication by the Medico-Botanical Society, and he subsequently received a prize for the same subject from the French Academy.

(1928.) *Ilex Paraguensis* is the *Yerva mate*, *Gongonha*, or *Jesuit's-tea*, of Paraguay. This plant has been lately discovered in Brazil, about Curitiba, as well as in Paraguay, where the Jesuits draw a large revenue from the consumption of its leaves, which, when infused, form a favorite drink. In Paraguay, La Plata, Chili, Peru, and Quito, this beverage is taken at all hours of the day. The tea is made by putting "a handful of the leaves into a kind of teapot, called *mate*, from the spout of which the hot liquor is sucked. Some persons mix sugar with it, and others add a few drops of lemon-juice, and by pouring fresh boiling water into the vessel the infusion may be renewed. The Creoles are very fond of it, and never travel without a supply. They drink this tea at every meal, and never eat until they have taken some of it. It must be drank directly it is made, for if suffered to remain long the liquor becomes as black as ink. The pipe to the *mate*, or teapot, is called a *bombilla*, and is perforated at the top, to strain the water from the powdered herb. A whole party is supplied by handing the mate and

pipe from one person to another, and filling up the vessel with hot water as fast as it is drained. The repugnance of Europeans to drink after all sorts of people, not of the most cleanly kind, and often labouring under communicable diseases, has caused the introduction of small glass pipes, with which each person is provided. About 200,000 arrobas of leaves, equal to five million pounds, are annually obtained from Paraguay; 110,000 arrobas of which go to Chili, whence Lima and Quito are supplied: the rest is consumed in the viceroyalty of Buenos Ayres. The leaves when green taste something like those of the mallow. When collected they are roasted, dried, and broken into small pieces before they are packed. There are three kinds of Paraguay tea, but all procured from the same plant. These go under the names of *Caa-cuys*, *Caa-mini*, and *Caa-guazu*. The first is prepared from the buds, when the leaves are scarcely expanded; the second of the membrane of the leaves stripped off the ribs before roasting; and the third consists of the leaves roasted entire without any selection. The *Caa-cuys* does not keep, and is consequently all used in Paraguay, and the aromatic bitterness even of the others is lessened by time and partly dissipated by carriage. The principal harvests of this herb are reaped in the eastern parts of Paraguay, and about the mountains of Maracaya; but it is also cultivated in the marshy valleys between the hills. The natives boast of the innumerable qualities the tea possesses, and in the mining countries its use is almost universal, from the opinion that prevails among the Spaniards that the wines are there prejudicial to health. Like opium, it produces some singular effects: it gives sleep to the restless, and spirits to the torpid. Persons who have once contracted the habit of taking it do not find it an easy matter to leave it off; or even to use it in moderation, although, when drank to excess, it brings on disorders similar to those which are produced by the immoderate use of spirituous liquors." (*Don.*)

(1929.) *Ilex Gongonha* is the Brazilian mate; and, before the specific distinctions were well made out, this plant was thought to be identical with the one last named, or only a variety of it. Since the exportation of tea from Paraguay has been prohibited by the Dictator, Dr. Francia, the inhabitants of the other states, who were formerly supplied from Paraguay, are obliged to use the Brazilian mate, which is found to be not so good, and the inferiority, which is probably owing to the difference of the plants, was once attributed to an imperfect mode of preparation.

(1930.) *Ilex vomitoria* affords the South-sea or Apalachian tea. This, in many works, is confounded with that of Brazil and Paraguay, the Jesuit's tea being erroneously said to be the produce of *I. vomitoria*. This plant is a native of North America, and is found along the sea-coast from Carolina to Florida. Its leaves are used by the Indians to make the black drink so much prized among them, not only as a medicine, but also a draught of etiquette at their councils, when matters of consequence are to be discussed. At a certain time of the year, the Indians come down in crowds, from a distance of several hundred miles, to the coast, for the leaves of this tree, which is not known to grow at any considerable distance from the sea-shore. They make a fire on the ground, and, putting a great kettle of water on it, they throw in a large quantity of the leaves, and then seating themselves round the fire, they begin drinking large draughts, which in a very short time occasion them to vomit easily and freely. They continue drinking

and vomiting for the space of two or three days, until they think they have sufficiently cleansed themselves, and then every one lading himself with bundles of the branches, they retire to their usual haunts and habitations. (*Don.*)

(1931.) Two species of *Myginda*, a genus allied to Ilex, and named in honour of Mygind, a German botanist, are reputed to be powerful diuretics. These are *M. Gongonha* and *M. Uragoga*, the latter of which is the *Yerba del Maravedi*, so called on account of the lowness of its price. Both leaves and roots are employed, but the roots are the most efficient.

(1932.) The *Prinos* of the Greeks was the Holm-oak, but the name is now given to several American hollies, which, although not generically the same, are closely allied to the Ilices of Europe. The bark of *P. verticillatus* is bitter, and has been substituted for Cinchona bark in the treatment of fever. Dr. Meere speaks highly of its antiseptic powers, and the American physicians recommend it in cases of gangrene, and as a lotion in cutaneous disorders. *P. glaber*, or the Ink-berry, is said to be one of the plants the leaves of which are occasionally used instead of those of the true Paraguay tea-plant (*I. Paraguensis.*)

(1933.) CELASTRACEÆ. *Celastrus*, *Euonymus*, and the other associated genera which form this type, are shrubs or trees, with alternate, seldom opposite, simple, rarely compound, leaves, the stipulæ being small, deciduous, or none. The inflorescence is axillary, the flowers small, united, and of a pale or greenish hue. The calyx is free, the sepals imbricate (rarely valvate) in æstivation, and persistent. The disk is large and fleshy, the petals, 4 or 5, are alternate with the sepals, and subperigynous, exserted by broad bases from the under edge of the disk, imbricate in æstivation, and deciduous. The stamens are definite (4-5), free, opposite the sepals, and exserted from the disk. The anthers are 2-celled and innate, with a longitudinal introrse dehiscence. The germen is superior, closely surrounded by the disk, and formed of 2-4 connate carpels. The ovules are definite, 1 or more in each cell, ascending, and attached to the axis by a short funicle, and the raphe is interior. The fruit is superior, either a 3-4-celled capsule, or a dry drupe with a 1-2-celled nut. The cells are 1 or many-seeded, the seeds ascending (rarely resupinate), and the albumen, when present, fleshy. The embryo is straight, axile, and green, the radicle short and near the hilum, and the cotyledons flat and foliaceous.

(1934.) Hence, differentially considered, the *Celastraceæ* are apopetalous *Ilicinæ*, with an imbricate (rarely valvate) æstivation, staminiferous disk, the stamens opposite the sepals, and superior ovaries.

(1935.) The *Celastraceæ* are distributable into three subtypes; which, from their respective normal genera, are named the *Staphylidæ*, *Celastridæ*, and *Dulongidæ*.

(1936.) The *Staphylid*æ are those Celastraceæ which have compound leaves, imbricate sepals, and exarillate truncate osseous seeds, with the albumen wanting, or very small.

(1937.) The *Celastridæ* are those Celastraceæ which have simple leaves, imbricate sepals, arillate non-truncate seeds, and fleshy albumen.

(1938.) The *Dulongidæ* are those associates of the Celastraceæ which have simple leaves and valvate sepals. Thus connecting this type with the following.

(1939.) *Staphylidæ*. The bladder-nut (*Staphylea pinnata*), is a large ornamental hardy shrub, and a favorite in plantations, but rather for its singularity

than beauty. Its bony polished seeds are strung as beads by the Roman Catholics in some countries; and, notwithstanding they are bitter, they are eaten by poor people and children on the continent. Gerarde says, when chewed, they at first taste sweet, but that the sweetness is succeeded by nausea.

(1940.) *Celastridæ. Celastrus* (κήλαστρος), was a name given by the ancients to several different plants which perfected their fruits at a late season of the year, such as the juniper, the holly, the spindle, and the staff-trees. The general term has however, in modern botany, become a special one, and it is now exclusively devoted to the staff-trees, so called from the use to which their stems and branches are commonly applied. *Celastrus cerifera*, a Chinese species, is said to yield a sort of lac, there called *Pe-la*, and of which candles are made. (Ferusac's Bull.) The leaves of *C. edulis* are eaten with avidity by the Arabs, who call the plant *cat* or *kat*, whence the name *Catha*, given by Forsk to this species, as well as to the *C. spinosa* or *parviflora*, which is said to possess nearly the same intoxicating properties as opium. An Indian Celastrus is reported to yield a kind of manna when punctured by an insect, hence called *Kermes mannifer*.

C. Maytenus, now *Maytenus Boaria*, is famed in Chili as an antidote to the subtle poison of the *Llithi* (*Rhus caustica*), which produces swellings on the bodies of those who sleep under its shade. It is used in decoction to bathe the swollen parts.

(1941.) *Euonymus*, the spindle-tree or prick-wood, has lost much of its ancient importance since the *jenny* has superseded the *distaff*, and *spinster* has become an empty name. Its wood is now rarely used except for making skewers and toothpicks, or for fuel. It is said to be employed on account of its toughness, if cut when in blossom, by watchmakers, for cleaning clocks and watches, and likewise in the construction of some parts of musical instruments. All parts of the plant are fetid; and deleterious to most animals, if taken as food. According to Linneus kine, goats, and sheep, eat the leaves, but horses refuse them. No animal, however, seems willingly to browse on it except the goat. The berries are said to be poisonous to sheep; and both the fruit and inner bark, if taken by man, are briskly purgative, and in large doses, emetic. The seeds, when powdered and sprinkled among the hair, form a very efficient *pulvis anti-pediculosus*, and in many places are employed to destroy vermin.

(1942.) *E. tingens* is the *Kasoori* of Hindustan, and the yellow bark of this plant is the substance used by the Nipalese to mark the forehead with the idolatrous symbol called *Tika*. *E. Americanus*, which is a very handsome shrub, is the *Burning bush* of the New World, so called on account of the colour of its fruit.

(1943.) *Alzatea* is chiefly interesting from forming, by its apetalous flowers, a notable transition from the Querneales to this order.

(1944.) *Elæodendrum* is the olive wood, ones pecies of which, *E. Argan*, is remarkable for affording an oil by expression from its pulpy fruit, like the olive, which is used by the Moors for all economical purposes; and domestic animals are fed upon the refuse marc.

The leaves of *E. glaucum* have an astringent and slightly bitter taste. They have been introduced into Europe under the name of 'Ceylon tea.'

(1945.) The *Hassagay* of the Cape of Good Hope is the *Curtisia faginea*, so named in honour of the deservedly well-known William Curtis, who commenced

that valuable work, the Botanical Magazine. The wood of this tree is used by the Hottentots and Caffres to make the shafts of their javelins or assagays, one or two of which they always carry with them. These weapons consist of an iron spear hollowed out on each side, about six inches long, and either with or without an iron shaft, which is sometimes round and smooth, and sometimes grooved. This is fastened by leathern thongs to a slender round stick tapering towards the end, made of the wood of this tree. These lances the Caffrarians and Hottentots hurl with great dexterity and force to the distance of a hundred paces, so that they serve not only to kill buffaloes and other wild animals, but become formidable weapons of defence.

(1946.) *Dulongidæ*. *Dulongia*, a South American plant, which commemorates Dr. Dulong, a learned physician, and *Perrottetia*, named after Perrottet, a botanical collector, who travelled through Guiana and Madagascar, constitute this small subtype, and by the valvate æstivation of their sepals form the passage from the Celastraceæ to the Rhamnaceæ. The properties of these plants are unknown, and it does not appear that they have hitherto been applied to any useful purposes.

(1947.) *Hippocratea*, *Brexia*, and *Pittosporum*, which establish a connexion between the *Celastrinæ* and *Acerinæ*, although classed by Bartling with the former, are perhaps rather referable to the latter group, on account of the hypogynous insertion of their stamens.

(1948.) Bruniaceæ. *Brunia*, *Berzelia*, *Staavia*, *Raspailia*, and their allies, associated to form this type, which seems to be intermediate between the *Celastraceæ* and the *Rhamnaceæ*, are heath-like shrubs, with much branched stems, small, alternate, subimbricate leaves, rigid, entire and acerose, with a callous point, exstipulate, and exserted in 5 rows from the branches. The inflorescence is paniculate, rarely solitary. The flowers are united, small, and often with large investing bracteæ. The calyx mostly superior, (inferior only in Raspailia,) the limb 5-cleft, the lobes imbricate in æstivation. The disk thin and adhering to the ovary. The petals alternate with the lobes of the calyx, and exserted from its throat. The stamens alternate with the petals, and arising either from the calyx or the disk. The anthers 2-celled, introrse, and bursting longitudinally. Germen half inferior, formed of 3, rarely 1, carpel, ovules solitary, or in pairs, suspended from the central column of the ovary, the styles 2-3, often connate, and the stigmata simple. The fruit is dry, dehiscent or indehiscent, the cells 1- or 2-seeded, the seeds pendulous, and sometimes furnished with a short arillus. The albumen is large and fleshy, the embryo small, straight, axile, and placed at the apex of the seed, the radicle conical and long, superior, and next the hilum, and the cotyledons short and fleshy.

(1949.) Hence, differentially considered, the *Bruniaceæ* are apopetalous *Ilicinæ*, with a semi-adherent calyx imbricate in æstivation. The petals alternate with the sepals, and the stamens opposite to them. The fruit dry, 1-3-celled, 1-2-seeded, and the seeds pendulous.

(1950.) There is a peculiar coincidence in one point of view between this type and the *Proteaceæ*, for, like it, the genera included have been dedicated to various celebrated philosophers, such as Berzelius the chemist, Le Brun the traveller, Staaf, Raspail, Berard, Audouin, Tittman, and others, and yet not one of the species

is known to have been applied, or indeed to be applicable to any useful purpose, or to be possessed of any notable properties whatever.

(1951.) Rhamnaceæ. *Rhamnus*, the buck-thorn, *Paliurus*, the Christ's-thorn, *Zizyphus*, the jujube, and the other genera associated to form this type, are trees or shrubs, with simple, alternate, rarely opposite leaves, and small, free deciduous stipules, which are sometimes wanting. The inflorescence is either axillary or terminal, and seldom solitary. The flowers are united, or monoclinious by abortion. The calyx free or adherent to the germen, synsepalous, 4-5-cleft, and

C

c. *Rhamnus catharticus.* Branch with leaves and flowers.

(*a*) Stamineous flower.

(*b*) Pistilline flower.

(*c*) Section of the fruit, to shew its 4 cells.

(*d*) A seed.

(*e*) Spinose branch with fruit.

valvate in æstivation. The petals exserted from the faux of the calyx, alternate with its lobes, cucullate, and convolute in æstivation, and often scale-like or abortive. The stamens definite, opposite the petals when present, and alternate with the sepals; the disk is fleshy, and lines the tube of the calyx. The germen is either free, or more or less adherent to the calyx, and immersed in the fleshy disk, 2-3-4-celled, and the ovules solitary and erect. The styles, equal to the carpels in number, are more or less united, and the stigmata are simple.

The fruit is mostly fleshy and indehiscent, 2-3, or rarely 4-celled, sometimes 1-celled by abortion; but occasionally dry and dehiscent. The seeds are solitary and erect, the albumen fleshy, sometimes evanescent. The embryo large and straight, with an inferior radicle, and flat carneous cotyledons.

(1952.) Hence, differentially considered, the *Rhamnaceæ* are a- or apo- petalous *Ilicinæ*, with simple stipulate leaves, valvate æstivation of the calyx, stamens opposite the petals or alternate with the sepals, and erect solitary seeds.

(1953.) *Paliurus aculeatus*, the Christ's-thorn, is a very common plant in Palestine, and is found in most sterile places bordering on the Mediterranean Sea. Tradition affirms that the Saviour's crown of thorns was made of the pliant

branches of this spiny plant, and none could be more fitting for the brutal purpose to which it is said to have been applied. Haselquist however is of opinion that a species of Zizyphus, hence called Z. spina-Christi, is the true Christ's-thorn.

The fruit of *P. aculeatus* resembles a head with a broad brimmed hat on; and the French, from its very singular appearance, call the tree *Porte-chapeau*. The seeds are sold in the herb and physic shops of Constantinople under the name of *Xalle*. The *hakims* or native doctors prescribe them in many complaints, and they are used also as a dye. The plant itself is one of the commonest thorns of the hedges in many parts of Asia, and its flexible spiny branches form fences of a most impassable kind.

(1954.) *Rhamnus*, the buck-thorn, is said to have been so named from its ramose port. *Rhamnus*, *ραμνος*, *ramus*, *rame*, and the obsolete French *reim*, being fancied to be the descendants of an old word, *ram*, a branch; and *Rheims*, which is but a slight variation of *reim*, bears two branches intertwined as the arms of the town.

(1955.) The inner bark and fruit of the Rhamni, as well as of most other plants in the type, are possessed of brisk cathartic powers, and some of them are also emetic and astringent.

(1956.) The young shoots and leaves of *R. alaternus* will dye wool of a yellow colour. Clusius reports that the fishermen in Portugal dye their nets red with a decoction of its bark, and that dyers there use the wood to strike a blackish blue colour. Evelyn says that its "honey-breathing blossoms afford a marvellous relief to bees," as they open very early in the spring.

(1957.) *R. catharticus* was formerly used in medicine; but it is a violent griping drastic purgative, and is seldom now employed. The syrup made from the juice of the ripe berries is the officinal preparation: and its action is mitigated by the addition of spice; it however, under any form, produces great dryness of the mouth and fauces, intolerable thirst, and is on the whole an unpleasant medicine. The juice of the unripe berries has the colour of saffron, and is used as a pigment and a dye, and the *vert de vessie* or sap-green of painters is made by inspissating the juice of the ripe berries to which alum or lime-water and gum-arabic has been added. If the berries are gathered late in the season, the colour becomes purple instead of green. The French berries of dyers are the unripe fruit of this plant. The bark also affords a beautiful yellow dye.

(1958.) The bark and berries of *R. tinctorius* are esteemed as dyes, and the fruit of *R. infectorius* is the Avignon berry, which is used to give its yellow colour to Turkey or morocco leather. This valuable dye-stuff is also procured from several other species of *Rhamnus*, such as the *amygdalinus*, *saxatilis*, *oleoides*, *buxifolius*, and *pubescens*, which are natives of the Levant, the southern parts of Europe, and the northern rocky ones of Africa. The wood of *Rhamnus Erythroxylon* is of an orange colour, and that of *R. Lycioides* of a fine red. This latter, on account of its hue and hardness, is used by the Monguls to make their images.

(1959.) *R. Frangula* is, like most of the other species, purgative, if taken internally, and affords both from its bark and berries serviceable dyes. Half an ounce of the liber, or a few of the berries boiled in beer, form a brisk cathartic, which is said to be very certain in its action on cattle; and both this plant and *R. catharticus* are esteemed in veterinary practice, to which it were well they

should be confined. Goats devour the leaves voraciously, and sheep will eat them. The flowers are, like those of *R. alaternus*, particularly grateful to bees. The bark will dye yellow, or, with preparations of iron, strike a good black. The unripe berries will dye wool yellow, when ripe green, and if gathered late and very ripe, the colour becomes blue. Charcoal made from the wood is much esteemed in the manufacture of gunpowder.

(1960.) The leaves of *R.* (now *Segeretia) Theezans*, which resemble those of the common tea, are said by Osbeck to be used as a substitute for genuine tea by the poor people in China, who call them *Tia*. They are aromatic and slightly astringent.

(1961.) The celebrated *Lotus* of the *Lotophagi* is the *Zizyphus Lotus* of modern botany, its present generic name being a variation of *Zizouf*, its Arabic appellation. It is a native of Persia, and grows wild in the interior of Africa, as well as on the sea-coast in the neighbourhood of Tunis; not being by any means so confined in its distribution as was conjectured by the Greeks; and the fruit is universally eaten by the inhabitants wherever it grows. Dr. Shaw says this fruit is common in the deserts and other parts of Barbary, and is still in great repute and sold in the markets all over the southern districts, and cattle as well as men are fed upon it. Park states that he found the Lotus abundant in all the countries of Africa he traversed, but in the greatest plenty in the kingdoms of Kaarta, Ludamar, and the northern parts of Bambara. The natives, he says, convert the fruit into a sort of bread, by exposing it some days to the sun, and afterwards pounding it gently in a mortar until the farinaceous part is separated from the stone. This meal is then mixed with a little water and made into cakes, which, when dried in the sun, resemble in colour and flavour the sweetest gingerbread. The stones are afterwards put into a vessel of water, and shaken about, so as to separate all the farina that adheres to them. An agreeable taste is thus given to the liquid, which, by the addition of a little pounded millet, is made into a kind of gruel called *fondi*, and this, for several months in the year, forms the common breakfast of the majority of the people in many parts of Ludamar. The fruit when dried is laid by for winter use; a sort of wine is also made from it by expression and mixing the juice with water. It is a pleasant drink, but will not keep many days. Some persons have conjectured that this wine is the same liquor which is fabled to have produced such extraordinary effects on the companions of Ulysses, as described by Homer:

> "The trees around them all their food produce;
> Lotos, the name divine, nectareous juice,
> Thence called Lotophagi, which whoso tastes,
> Insatiate riots in their sweet repasts,
> Nor other home nor other care intends,
> But quits his house, his country, and his friends."

(1962.) *Zizyphus spina Christi*, which Haselquist thinks to be the true Christ's-thorn, bears a fruit of a pleasant flavour, that is esteemed as food in Egypt and Arabia. The fruit of several other species is esculent, and more or less palatable. The kernels of *Z. Xylopyrus* taste like nuts, and the leaves and shoots are eaten by cattle. *Z. Napeca* is very acid and astringent, and the berries are chiefly used

as sauce for fish, or to eat with salted provisions. Z. *orthocantha* is eaten by the natives of Senegal, and a sort of wine made from it as from the lote.

(1963.) The *Jujube*, which is a favourite dessert in Italy and Spain, either fresh or dried as a sweetmeat, is the fruit of Z. *vulgaris* and Z. *Jujuba*, and a pleasant pectoral lozenge is made of it by the French pharmaciens. The fruit is to be seen in abundance in the markets of Constantinople and the southern parts of Europe. The Turks call it *Hunnab-agaghi*, and plant the trees before their coffee-houses, that they may enjoy both their shade and fruit. It is said that the Z. vulgaris was introduced into Italy from Syria by Sextus Pampinius, in the time of Augustus.

(1964.) The leaves of *Ceanothus Americanus* form the New Jersey tea, and are used in some parts of North America instead of the Chinese leaf. The root is said to be astringent, and it will dye wool of a nankeen or cinnamon colour.

(1965.) The wood of *Scutia Sarcomphalos* is hard, of a dark colour, and close grained; and is regarded as one of the best timbers of Jamaica. The roots of *Berchemia volubilis* are prescribed with advantage in cachectic disorders, and the peduncles of the *Hoveniæ dulcis et inæqualis*, which, after the petals have fallen, become enlarged and succulent, and filled with a sweet red pulp, have something the flavour of a pear, and are esteemed as a fruit by the Japanese. This peculiar development of the fruit-stalk, which is here found in a state of anamorphosis, is evidently an anticipation of the fruit of the cashew nut, and foreshadows the cynarhodon and the pome.

TEREBINTHINÆ.

(1966.) As parasitic plants were once considered to be the protruded entrails of the trees and herbs on which they grow, and hence were called *viscera*, the misletoe being named, according to its site, the *viscus quercûs*, *viscus oxyacanthi*, &c.; and the dodders, *viscera diaboli;* so the various gums and resins exuding naturally from numerous plants were sometimes regarded as their excrements. The turpentines were amongst the more valuable of these vegetable excrements; and, from their being in general procured by boring holes, or in some way wounding the wood and bark, especially in the pistacias, it has been supposed, perhaps without much probability, that they derived their name. For *terebinth*, *tereminth*, and *terminth*, Τερέβινθος, Τερεμινθος, τέρμινθος, whence the Latin *terebinthus* and *terebinthinus*, and the English *turpentine*, are all but slight variations of the same word, which speculative etymologists believe to be a compound of Τερέω and μίνθος.

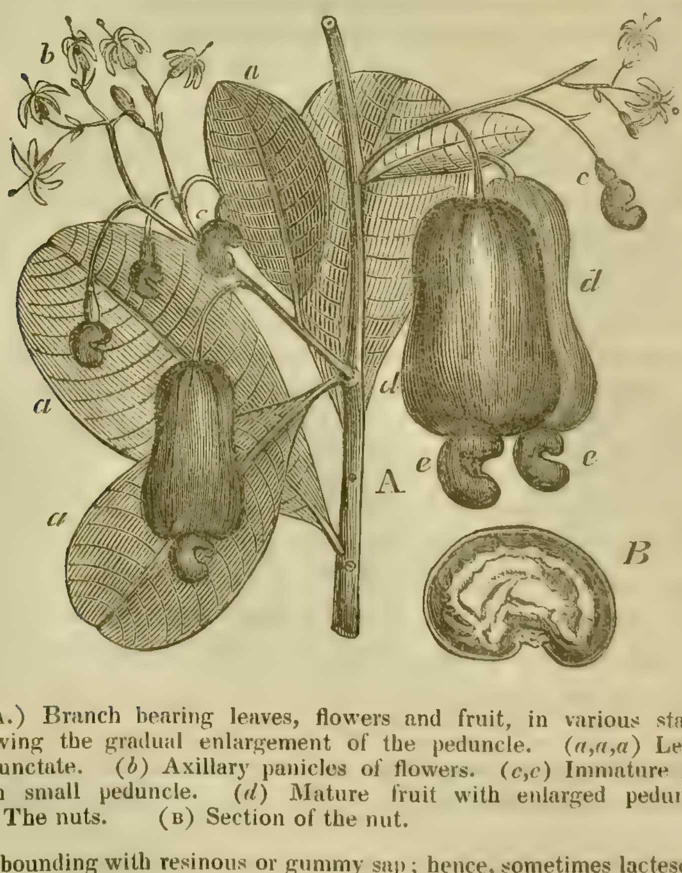
(1967.) The cashew nut (*Anacardium* or *Cassuvium*), the balsam trees (*Burseræ*), and the hog-plum (*Spondias*), are the normal genera of the three types, *Cassuviaceæ*, *Burseraceæ*, and *Spondiaceæ*, included in this section. Whether the *Connaraceæ* should be associated with the foregoing types is questionable, as they are transitional

to the following section, from which indeed they are scarcely to be distinguished. Along with the above-named groups Bartling has arranged the *Quassias*, *Oranges*, and *Rues;* but, although many points of similitude may be traced, they are probably those of analogy rather than of affinity; and hence, adopting the opinion of De Candolle, they are here, on account of the hypogynous exsertion of the stamens and petals, referred to in the sub-order *Rhœadosæ*.

(1968.) The TEREBINTHINÆ, differentially considered, are resiniferous myrtosæ, with mostly exstipulate dotted leaves, and imbricate æstivation of the calyx; superior ovaries, few in number, exalbuminous seeds, and the radicle of the embryo turned towards the hilum.

(1969.) CASSUVIACEÆ OF ANACARDIACEÆ. *Anacardium*, *Pistacia*, *Rhus*, *Schinus*, and their allies, which are associated to form this type, are trees or

Anacardium or *Cassuvium Occidentale.*



(A.) Branch bearing leaves, flowers and fruit, in various stages, shewing the gradual enlargement of the peduncle. (*a*,*a*,*a*) Leaves impunctate. (*b*) Axillary panicles of flowers. (*c*,*c*) Immature fruit with small peduncle. (*d*) Mature fruit with enlarged peduncle. (*e*) The nuts. (B) Section of the nut.

shrubs, abounding with resinous or gummy sap; hence, sometimes lactescent, and their juices occasionally caustic and highly poisonous. The leaves are alternate, simple or compound, exstipulate and impunctate. The inflorescence is either

terminal or axillary; the flowers are usually separate, rarely monoclinious, and collected into spikes or panicles. The calyx is for the most part small and persistent; formed of 5 (or occasionally 3, 4, or 7) sepals, united by their edges and imbricate in æstivation. The torus is expanded, adherent to the tube of the calyx, and both corolliferous and staminiferous. The petals (occasionally wanting) are exserted from the margin of the disk; when present, they are equal in number to the lobes of the calyx; and, like it, imbricate in æstivation. The stamens are alternate with the petals, and either equal to them in number or twice as many, or more, and either of the same height or alternately shorter, some being occasionally abortive. The disk is mostly present, fleshy, and expanded, as a lining to the tube of the calyx. When the disk is present the filaments are free; when absent, they cohere at the base. The germen is superior, (seldom inferior,) and consists usually of a single carpel, very rarely of more, (5 or 6, of which 4 or 5 are abortive.) The ovarium is 1-celled and uniovulate. The styles 1-3, occasionally 4, being equal in number to the ovaries, and the ovule is attached by its funicle to the bottom of the cell.

The fruit is indehiscent and drupaceous, commonly with a fleshy, sometimes with a dry mesocarp. The seed is solitary and exalbuminous, and, like the ovule, pendulous from the point of a funicle arising from the bottom of the cell. The embryo is curved, and the radicle either superior or inferior, but always directed towards the hilum; and the cotyledons, either foliaceous or thick and fleshy, and occasionally turned back upon the radicle.

(1970.) Hence, differentially considered, the CASSUVIACEÆ are impunctate Terebinthinæ, with monospermous carpels, and the seed pendulous from a basal funicle.

(1971.) The *Cassuviaceæ* are distributable into two subtypes, the *Pistacidæ* and *Sumachidæ*.

(1972.) The first (viz. the *Pistacidæ* or *Anacardidæ*,) includes *Anacardium Semecarpus*, *Holigarna*, *Mangifera*, *Pistacia*, *Melanorrhœa*, and all the other genera in which the cotyledons are thick and fleshy.

(1973.) While the second, the Pistacidæ, includes those genera which, like *Rhus*, *Mauria*, and *Schinus*, have the seed-lobes foliaceous.

(1974.) *Pistacidæ*. The *Cashew* has been named *Anacardium* from a fancied resemblance between its fruit and the heart of a bird. *Cassuvium*, and its English name Cashew, are modifications of the Indian Acajou, whence indeed it was called by Gaertner, Acajuba. There are two varieties, or perhaps distinct species of Cashew. The Indian (*A. Indicum*,) and the American (*A. Occidentale* or *Americanum*.) The fruit consists of an enlarged peduncle, which becomes after the flowers have fallen fleshy and succulent, and considerably outgrows the nut or true fruit, which it bears on its apex. The enlarged fruit-stalk, which is called the apple, has a very agreeable acid flavour, slightly astringent, and is much esteemed in the West Indies. The juice expressed from it, when fermented, forms a pleasant drink, and yields by distillation a spirituous liquor, far superior to rum or arrack, and which makes excellent punch. The apple is often sliced into punch to give it a pleasant flavour by the West Indian planters; and the Cashew wine and spirit are esteemed powerful diuretics. The Cashew-nut is about the size and shape of a hare's kidney, and between the two layers of the pericarp there is found a considerable quantity of acrid inflammable oil, which should be

burned out before the nuts are eaten, or care be taken in removing the shell, for if incautiously cracked with the hands or teeth, the caustic oil will blister the lips or excoriate the skin wherever it touches. It has hence been used with success in the treatment of ring-worms, corns, and even as a dressing for ill-conditioned ulcers. The kernel abounds with a milky juice, and when fresh has a most delicious flavour. When ground with *Cacao* the nuts much improve the taste of the chocolate, and they are also often made into delicate puddings. The broken nuts are imported for the purpose of steeping in old Madeira wines, to restore and improve their flavour. It is said, that timber smeared with the nutshell oil is prevented from decaying; and that it tinges linen of a rusty iron colour, which it is very difficult to remove; the branches and trunk also afford by incision a milky juice, which stains linen of a deep black, that is indelible. Long, in his History of Jamaica, likewise states that each tree annually exudes from 5 to 10 or 12 lbs. of a fine semitransparent gum, similar to gum arabic, and not inferior to it in virtue or quality, except that it has a slight astringency, which however may render it for some purposes more valuable.

(1975.) *Semecarpus*, the marking-fruit, is so called from σημειον and καρπος, on account of the use to which the resinous juice of the fruit has been long applied. This juice, when the nut is unripe, is of a pale milk colour; but when the fruit is mature, it becomes of a deep black; and as its stains are indelible, it forms a natural marking-ink. The fleshy peduncles are eaten, as are those of the cashew, but they are not so much esteemed; when raw, they are too acrid and astringent to be agreeable food, and especially as they leave a painful sensation on the tongue, which remains for some time after they are eaten. When roasted, this is avoided, and they then taste something like roasted apples. The kernels are seldom eaten. The unripe fruit, when pounded, forms a sort of bird-lime; and the black acrid juices are used to relieve rheumatic pains, and are much esteemed by the Telinga physicians in other complaints. As a marking-ink, the sap is improved by the addition of quick-lime and water, which prevent its running. The timber is soft and not much employed, as its acrid juices injure the workmen.

(1976.) Several other allied plants abound in black resinous juices, like those of the *Semecarpus*, and which are made into black varnishes in India and China. Thus the Silhet varnish is principally procured from the *S. Anacardium*, that of Martaban from the *Melanorrhœa usitata*, which is figured in Wallich's *Plantæ Asiaticæ Rariores*. The Burmese *black lac* is believed to be the produce of this plant, or a near associate; and even the common cashew-nut oil is sometimes made into a varnish. The *M. usitata* is the majestic *khue* or varnish-tree of *Munipur*, which grows to the height of a hundred feet. In the Burmese empire it is called *Theet-tsee* or *Zit-si*, and Mr. R. Smith, who resided a long time in Silhet, considers it to be the varnish of the Chinese, at least of the eastern and north-eastern provinces. It is procurable in great quantities from Munipur, where it is used for painting river-craft and for varnishing vessels designed to hold liquids. The drug is conveyed to Silhet for sale by merchants, but care is required in its transport, for, on being touched, it occasions painful erisepelatous swellings attended with pain and fever; these untoward effects are not, however, of long duration. In the neighbourhood of Prome a considerable quantity of varnish is extracted from the tree. To procure it, short joints of bamboo, sharpened at one end and shut up at the other, are inserted in a slanting direction

into holes made in the trunk and principal branches, and left there for twenty-four or forty-eight hours; after which they are removed, and their contents emptied into baskets prepared for the purpose by being previously varnished. Sometimes a hundred bamboos may be seen sticking into one tree at the same time during the collecting season, which lasts from January to April, that is, while the tree is destitute of leaves; for, as soon as the foliage is renewed, the varnish ceases to flow. Besides being used to varnish every article for domestic use destined to hold liquids, it is also employed in the process of gilding; and, as it is among the most frequent acts of devotion in Burmah to contribute towards the gilding of their numerous religious edifices and idols, vast quantities of this valuable varnish are consumed for such purposes alone. The beautiful *Pali* writing of the Burmah ecclesiastics, on ivory, palm-leaves, and metal, is entirely done with this varnish in its fresh and pure state.

(1977.) The *Comocladiæ*, like the preceding Cassuviaceæ, abound with resinous acrid juices, the stains of which are so indelible, that in St. Domingo, the sap of *C. integrifolia*, when part of the island was in the possession of the French, used to be employed by the planters to mark their negroes. Its caustic juice disorganises the skin, and leaves a dense black scar irremovable by art. *C. dentata*, which in Hayti is called *Guao*, is remarkable for the sulphureous odour of its fruit; and the natives affirm that it is dangerous to sleep under its shade; Jacquin, however, who was for sometime exposed to its influence, did not feel any hurt. *C. ilicifolia* dyes black, the wood of *C. integrifolia* red; and the fruit of this latter, which is acidulous, is eaten by the young Creoles. When fully ripe, however, it is said to be deleterious. Its sap is also used by the negresses as a depilatory.

(1978.) The *Mango* is the fruit of the *Mangifera Indica*. In India it is much prized, and is, of all tropical fruits, one of the most grateful to Europeans. There are many varieties of Mango, varying not only in weight from a few ounces to several pounds, but also in flavour; some have a most delicious aromatic, sweet, and subacidulous taste, while in others the resins so much abound, that the flesh is ill-flavoured, and often so fibrous, that they have been truly said to resemble nothing so much as a mixture of 'tow and turpentine.' Jellies, conserves, tarts, &c. are made in India from the unripe fruit, which is brought to Europe as a pickle. During the hot months the ripe fruit is scarcely ever absent from the dessert of the gentry of Hindustan. If eaten without wine it is apt to occasion boils, especially in new comers, but these are thought to be conducive to health.

The seeds are said to be possessed of anthelmintic powers, and the leaves to relieve the toothach. The wood is also esteemed as fuel, and is burned along with sandal, but only by persons of distinction.

(1979.) *M. sylvatica* is the *Lukshmee* of Silhet; its fruit is eaten by the natives, and kept also for medicinal purposes, but it is by no means palatable, resembling the worst kinds of common mango.

M. fœtida bears a strong-scented fleshy fruit of an acid flavour, which is reputed to be unwholesome. It is however eaten by the Malays. Its timber, when soaked in water, is used for flooring and common purposes, but it is an inferior wood.

(1980.) *Pistacia* (πισταкια) is an alteration of the Arabic name of the

plant, which is *foustag*. The *Pistacias* are diœcious trees, and in Sicily, where *P. officinalis* abounds and its nuts are esteemed as food, a ceremony similar to the marriage of the palms is performed, by cutting branches off the staminiferous trees, and suspending them over the pistilline flowers, to ensure the fertilization of

C

Pistacia vera.

c. Branch with leaves and fruit.

(*a*) Cluster of pistilline flowers.

(*b*) One separated.

(*c*) Section of ditto.

(*d*) Longitudinal section of the fruit.

(*e*) Transverse section.

(*f*) The seed.

(*g*) The embryo.

the seeds. The gardeners also often ingraft stamineous buds upon the pistilliferous plants, which is a permanent assurance of fair crops of fruit. Pistachio nuts are brought to this country, and esteemed as a delicate fruit; on the Continent they are used commonly as food, and enter into the composition of ragouts and various dishes.

The *Narbonne* pistachio nuts are the fruit of P. reticulata; they are as good as those of the preceding plant, and those of P. atlantica are also eaten by the Arabs: they are slightly acid, and are mixed with the date-cakes. This latter Pistacia yields a resin similar to *Mastic*.

(1981.) *Pistacia Lentiscus* is so called on account of the viscidity of its exudations. This tree affords the true Mastic of commerce, which is procured by making transverse incisions through the bark, whence the glutinous juices escape, and, when inspissated by exposure to the air, are collected in the form of tears. In Chio the trees abound in mastic, but those which grow in Barbary yield little or none, the wood, however, is prized as fuel on account of its fragrance; and, according to Des Fontaines, an oil fit both for the table and for burning is procured from its fruit. In Provence, and various other places where the mastic trees grow, they are devoid of resin even more completely than in Barbary, and this fact will explain the circumstance of some genera in this natural order not being resiniferous. Mastic is considered astringent and diuretic, but it is very little employed in medicine. In Turkey and Armenia the women chew it to give a pleasant smell to their breath. It forms a good dentifrice, and is said to relieve

the toothach. Dentists use it occasionally to stop carious teeth, and in Portugal the wood is made into toothpicks. Its chief consumption in Europe is by japanners and artists, as it enters into the composition of several varnishes.

(1982.) The Cypress or Chio turpentine is procured from the *P. Terebinthus.* To obtain this costly drug numerous incisions, about three inches apart, are made in the trunks and branches of the trees during the month of July, and the exudations, which are received upon pieces of stone, are scraped off as soon as they are sufficiently inspissated, or rather condensed by cold, for this part of the process is always done before sunrise: and if any extraneous matter has got mixed with the turpentine, it is again liquefied by the sunbeams to free it from impurities. The quantity yielded by each tree is very inconsiderable; from four large ones, sixty years old, only 2 lbs. 9 oz. 6 dr. could be collected, and hence its high price when genuine, and the great temptation to mix it with cheaper turpentines. It is astringent and diuretic, and in free doses is serviceable in lumbago, and also in various morbid fluxes.

The leaves of this plant are subject to the attacks of an insect called Aphis Pistaciæ, and when punctured by it, galls are produced of the size of nuts or sometimes larger, occasionally being found six inches long. They are filled with a resinous fluid having the smell of turpentine, and in old works are called the '*Apples of Sodom.*' They are employed to dye fine silks, and in the Levant form an important article of commerce.

(1983.) The nuts of *P. oleosa* contain a yellow fragrant oil, which thickens on exposure to air. Its bitter taste prevents its being used as food, but it is employed by the natives of Cochin-china to anoint their heads, and to scent pomatum. This plant is the *Cussampi* of the Molluccese, who eat the kernels of the fruit, and also burn the oil. It yields neither mastic nor turpentine.

(1984.) *Sumachidæ. Rhus,* the most important genus in this subtype, contains nearly a hundred species, which are distributed into several subgeneric groups, viz. *Cotinus, Metopium, Sumach, Toxicodendron, Rhus, Thezera,* and *Lobadium.*

(1985.) *Rhus Cotinus* is the Venus sumach or wild olive, the Scotino of the Italians, who use the wood, bark, and leaves for tanning leather. The modern Athenians employ the wood to dye wool of a rich and beautiful yellow.

(1986.) *Rhus Metopium* is the hog gum-tree of Jamaica, so called from those animals being said to resort to it as a dressing for their sores when wounded in the woods. It yields an abundance of a yellow gum-resin, called doctors' gum by the colonists, which is made into plasters, and is much esteemed. Taken internally, it is said to be an easy purgative and a most powerful diuretic.

(1987.) Of the *Sumachs, R. Typhina* and *Coriaria* are both used by tanners, and are likewise considered febrifuges; all the Turkey leather is said to be tanned with the latter. Its leaves and seeds are also used in medicine, being considered tonics; and in Aleppo the seeds are sold by the Tripoli merchants to provoke an appetite. The fruit of *R. glabra* is very acid, but is eaten in North America it is also used for dyeing red, and the bark boiled with the fruit forms a very black ink-like dye.

(1988.) *R. pumila* is a very noxious plant, perhaps the most poisonous species among several that are highly deleterious. Mr. Lyon says that while gathering the fruit he was poisoned all over his body, and became lame for a considerable time.

(1989.) *R. succedanea* yields an oil, by expression from its seeds, of the consistence of suet, which is used in Japan and China for making candles. Its sap also is resinous, and might be employed as varnish.

(1990.) *R. vernix* yields the true Japan varnish, which is far superior to that of either China or Siam. The Japanese use it to varnish almost every article of domestic economy, their furniture, and even the windows and doors of their houses. The sap of the plant is however very deleterious when fresh, producing inflammation and blotches on the skin, followed by vesication, and attended by intolerable itching. Some persons are said to be proof against its malevolence, and others to become affected even by smelling the plant.

(1991.) *R. venenata* and *R. perniciosa* are other two deleterious species, the effects of which are very similar to those produced by the R. vernix. Sauvage says the former stains linen black, and the marks remain permanent even after many washings. From the fruit of R. semi-alata the Chinese extract an oil by bruising and boiling it, which they employ as a varnish. *R. juglandifolia* and *R. copallina* are also very poisonous plants, but the leaves of the latter are used notwithstanding as tobacco by the American Indians on the banks of the Missouri and Mississippi.

(1992.) *R. Toxicodendron* and *radicans* are both deleterious plants, but less active than *R. venenata* and others already mentioned. Severe erysipelatous inflammation has, however, been known to follow the application of a small quantity of sap to the cheeks and eyelids: an instance of this occurred a few years since to an under-gardener at Chelsea, who was employed to gather the leaves of the R. Toxicodendron for medicinal purposes, and, chancing to rub his face while his hands were moist with the sap of the plant, a violent inflammation of the parts followed, the whole head became enlarged, and the swelling extended down the arms and over the chest. Indeed, so severely did he suffer for his imprudence, that he was confined to the hospital for several weeks.

The powdered leaves and a decoction of them have been recommended in cases of consumption, and have been thought to have some influence in restoring motion and sensation to paralyzed limbs. But the evidence of their beneficial effects is not very decided.

(1993.) The fruit of *R. Thezera* has, when ripe, a pleasant subacid flavour, and is eaten in Sicily and Barbary. The bark dyes red, and also is used to tan leather.

(1994.) *Lobadium* is a subgenus formed by the old *R. suaveolens* and *aromatica*, which are said to be only the stamineous and pistilline forms of the same species. They are aromatic shrubs; and the expressed oil of the seed becomes concrete on exposure to air, and is, like that of R. succedanea, used in Carolina to make candles.

(1995.) *Stagmesia verniciflua*, as its name imports, yields a varnish; it is a native of Sumatra and Borneo, and, like the R. caustica (*Llithi*,) it is said to injure the hands of those who touch it, and to produce swellings on the bodies of such persons as sit and sleep under its shade [§ 1940]; and the same is reported of some of the Schini, as *S. Mulli*, the *arroeira* plant.

(1996.) The *Schini* are so replete with resinous juices that they are discharged from their leaves spontaneously and fill the air with fragrance, especially after rain. The same thing occurs if the leaves are put into water; and so forcible is the expulsion of the secretions, that the leaves seem from the recoil to possess

spontaneous motion. The fresh juicy bark of the *Mulli* or *Arroeira* plant (*S. Mulli*, often improperly called *molle*,) is used in Brazil to give a dark brown preservative coating to ropes, by rubbing them with it. The Peruvians are said to make a sort of wine by boiling the berries of this plant, as well as a kind of honey, and by fermentation a good vinegar. The resinous exudations something resemble mastic, and are used to corroborate spongy gums. Its juice is also a favorite Indian application to sore eyes.

(1997.) SPONDIACEÆ. The hog-plum (*Spondias*) has been made the typical genus of a very small group of plants which are closely allied to the *Cassuviaceæ*, the chief difference being their compound fruit and non-resinous juices. Indeed, it was at one time included amongst the *Pistacidæ*, and might be sufficiently distinguished if considered a subtype of the *Cassuviaceæ*.

(1998.) The *Spondiaceæ* are arboreous plants destitute of spines, with alternate unequally pinnate, or by abortion simple dotless leaves devoid of stipulæ. The inflorescence is either axillary or terminal, in spikes or racemes. The flowers are monoclinious, sometimes diclinious. The calyx synsepalous, 5-cleft, and regular, but either persistent or deciduous, and imbricate in æstivation. The petals are 5, exserted from below the disk which surrounds the ovary, and subvalvate or scarcely imbricate in æstivation. The stamens are 10, perigynous, and exserted with the petals. The disk is annular in the pistilline flowers, and orbicular in the stamineous ones, with 10 indentations. The ovarium is superior, sessile, 2-5-celled, and the locules uniovulate. The styles are short, and the stigmata obtuse. The fruit is drupaceous, containing a 2-5-celled nut, the cells of which are monospermous. The seeds are pendulous and exalbuminous, the radicle superior or inferior, and the cotyledons plano-convex.

(1999.) Hence, the *Spondiaceæ*, differentially considered, are non-resinous *Terebinthinæ*, with alternate, impunctate leaves; an annular disk, and superior concretê carpella with solitary pendulous seeds.

(2000.) The fruit of the several species of Spondias, especially the *Mombin*, the *Zanzee*, and the *Oghigee* hog-plums, are eatable; they are slightly acid and aromatic, but have a very peculiar taste, which, although agreeable to palates accustomed to the flavour, is not relished by Europeans. The fruit of *S. lutea*, the *Hobo*, is also considered agreeable, and aromatic, and is eaten by children, but its chief consumption is as food for hogs.

(2001.) *Poupartia*, which is sometimes associated with *Spondias*, but said to belong to *Burseraceæ*, the following type, by Dr. Brown, forms the transition from this group to the next. *P. mangifera* is the *Dapo* of Java and Hindustan; its fruit is said to be eatable, and agreeably fragrant. *P. dulcis*, the old *Spondias dulcis*, is cultivated to a great extent in the Society and Friendly Isles, especially in Tahiti, where the fruit is much esteemed. Report speaks of it as having a delicious flavour, resembling that of the pine-apple, although its smell is disagreeable.

(2002.) BURSERACEÆ. *Bursera*, *Boswellia*, *Balsamodendron*, and the other *Terebinthinæ* associated to form this type, are shrubs or trees abounding with balsamic juices, and having alternate, unequally pinnate, impunctate leaves, with or without stipulæ.

The inflorescence is axillary or terminal, and varies from racemes to panicles.

The flowers are united, rarely separate; the calyx is synsepalous, with 2-5 nearly regular divisions. Petals 3-5, exserted from the calyx below the disk, and usually valvate in æstivation. Stamens twice or four times as many as the petals, perigynous, and all fertile. Disk orbicular or annular, ovarium 2-5-celled, superior, and sessile. Style short or absent, with the stigmata equal in number to the cells of the ovary. Ovules in pairs, collateral, and attached to the axis. Fruit drupaceous, 2-5-celled, the outer coat often splitting into valves. Seeds exalbuminous. The radicle superior, straight, and turned towards the hilum, and the cotyledons either wrinkled and plaited, or fleshy.

(2003.) Hence, differentially considered, the *Burseraceæ* are resinous *Terebinthinæ*, with an annular disk, superior concrete carpella, and 2 collateral ovules in each cell.

(2004.) The source of *Olibanum*, the especial incense of the ancients, has long been a matter of doubt. Supplies of this resin were formerly drawn only from Africa, and it is said by some to have been called *Gum Thuris*, on account of its being brought by the merchants from *Thur* or *Thor*, a port in the North Bay of the Red Sea, near Mount Sinai, and in order to distinguish it in commerce from gum arabic, which was chiefly exported from Suez. This explanation is more probable than that which would derive the Latin *Thus* from θυω, referring to the use of the resin in sacrifices, because its Greek name is *Libanos*, a word evidently the same with *Lebonah* or *Luban*, its Hebrew and Arabic appellations. Linneus supposed the Olibanum of Africa to be procured from a species of juniper (*J. Lycia*), but of this no satisfactory evidence has been adduced; and the assumption is now generally denied. Lamarck has since referred to the *Amyris Gileadensis* as its source, and Sprengel to the *A. Kataf*. It is more than probable, however, that olibanum, or balms which so closely resemble it that they pass current in commerce, may, like gum-arabic, be afforded by several different plants. And of this there seems to be evidence offered by Messrs. Turnbull and Colebrooke, who have shewn that a gum collected in the mountainous regions of central India, and sent to this country without a name, but which the London drug-merchants recognised as *Olibanum*, and which now forms the greater part of the Olibanum used in Europe, is an exudation from a tree called, in India, *Sali*, the *Boswellia serrata* of botanists.

The Indian olibanum is said, by the French pharmacologists, to be less pure than the African, and some other slight differences have been observed; but, whether these are attributable to the modes of collecting it, or to any difference in the plant from which it is procured, is at present unknown; that the African olibanum is not the produce of *J. Lycia*, is assumed by the French from numerous observations they have made on that plant, which grows freely in the South of France.

(2005.) Olibanum administered internally is stimulant and diaphoretic; it is, however, little used in British medicine, its chief consumption here being as a fumigation, mixed with other aromatic gums, in sick chambers. It is believed to have been one of the ingredients in the sweet incense of the Jews; and it is still burnt as incense in the Greek and Romish churches, where the diffusion of such vapours round the altar forms a part of the prescribed religious service.

(2006.) *Boswellia glabra*, the *Gugulapootschittoo* of Coromandel, is a large

tree which yields a resin when the bark is wounded, that the Hindoos burn as incense in their temples; and which, when mixed with oil, is also, as Don observes, employed for the more useful purpose of marine pitch. The wood of this tree is hard, heavy, and durable.

The *Boswelliæ* differ from the rest of the *Burseraceæ*, in having a capsular instead of a drupaceous fruit. This deviation anticipates the legumes of the *Cicerinæ*, and is an interesting physiological phenomenon.

(2007.) *Balsamodendron*, called emphatically THE *Balsam tree*, produces those resinous drugs known as Balm of Gilead, Balsam of *Mecca*, *Balsamum Judaicum*, &c. These balsams seem to be afforded indifferently by several species; the first is however generally considered to be the produce of B. Gileadense, and the second of the *B. Opobalsamum*. But similar balsams are procurable from *B. Kataf* and *Kafal*. The *Kataf* affords a sweet-scented red powder, with which the women in Arabia wash and perfume their hair; and the Kafal balsam is said to be purgative. Nees Von Esenbek is of opinion that myrrh is the produce of a species of this genus, which he calls B. Myrrha.

(2008.) *Icica*, an allied genus, contains several species of similar resiniferous trees, the balsams procured from which are used as vulneraries, and burnt as incense. *I. heterophylla*, or *Aracouchini*, of Guiana, bears a very fragrant fruit, which is carried about their persons by the natives, and sent as a valuable present to their friends: with the turpentine afforded by this tree, and also that which flows from I. Guianensis, heptaphylla, and others, the Caribs perfume the oil with which they anoint their bodies to keep off the rain, and to defend them from the attacks of insects. *I. Icicariba* yields a resin that resembles *Elemi*, for which it is often substituted. And the wood of *Icica altissima*, two varieties of which are the red and white cedars of Guiana, is very durable, especially the former, which is used for making household furniture, boats, canoes, &c.

(2009.) *Bursera*, the genus which gives its name to the type, is dedicated to the memory of *Joachim Burser*, a pupil of *Caspar Bauhin*. Its several species yield resinous juices, useful for various purposes. From *B. acuminata* is procured a yellow concrete oil; and from *B. gummifera*, both a fluid turpentine and a concrete resin, resembling mastic, and applicable to the same purposes. The wood of *B. serrata* is close-grained and hard, as tough as oak, and heavier. It is considered in Bengal as a good timber in carpentry.

(2010.) The nuts of *Canarium commune*, and *sylvestre*, are eatable; those of the former are cooked in various ways, and bread-cakes and biscuits made from them for ordinary consumption. In the Moluccas, Banda, and New Guinea, the balsam is said to have the same medicinal properties as that of Copaiba. The turpentine of *C. microcarpum* is frequently used in the eastern dockyards instead of pitch, and mixed with chalk and oakum to calk vessels. It is commonly called *Damar*.

The fruits of *C. album* and *Pimela* are pickled in China and Java, and used as olives. They are recommended for assisting digestion and provoking an appetite.

(2011.) *Colophonia Mauritania* yields the *Bois de Colophone* of the Isle of France, and by wounding the stem an abundance of resin is procured, which is used in medicine, and is applicable to all the purposes of common turpentines and pitch.

(2012.) *Hedwigia* (the old *Bursera*) *balsamifera* affords a balsam analogous to that of copaiba both in smell, taste, and properties. It is the wild-boar tree

of St. Domingo, so called because the natives report that those animals, when wounded, strip off its bark and rub themselves with the resin that exudes.

(2013.) Several species of *Elaphrium*, such as *E. tomentosum*, *Jaquinianum*, and *excelsum*, yield fragrant balsams, similar to those previously described, such being indeed the general produce of the *Burseraceæ;* and the fruit of others is occasionally eatable, as that of *Garuga pinnata*, which is however unpleasant in a raw state, but makes a very good pickle.

(2014.) The *Amyrides* are plants, similar in their products and in several points of structure to the *Burseraceæ*, so that they are usually associated with them. De Candolle arranges them as the following group, and Bartling even makes them both co-ordinate sub-types. But it does seem that their affinities are stronger with the *Aurantiaceæ* and *Rutaceæ*, as suggested by Kunth, both on account of their dotted resiniferous leaves, and the hypogynous exsertion of their stamens: characters which agree with the latter groups, but are at variance with the former.

CICERINÆ.

(2015.) The ordinary *Pulse*, so called from the Hebrew *Phul*, a bean, or the Latin *Puls*, bean-meal gruel, or pottage, and not on account of their being *pulled* or gathered for food, as some lexicographers assert, form, with their numerous allies, a large and very important natural group of plants, which has been variously subdivided, and differently named. From their *legumes*, or podded fruits, they have been called, collectively, *Leguminosæ*, both by Jussieu and De Candolle, who in this follow Ray and the earlier writers. By Tournefort and the Corollists in general, as well as by Ray, in his first system, they were named *Papilionaceæ*, on account of the resemblance their blossoms bear to butterflies with expanded wings, a likeness long perceived, although it was reserved for a modern philosopher to imagine that the first butterflies might have been such flowers, which got loose from their stalks and flew away. Linneus divided the *pulse*, which Jussieu and De Candolle have again conjoined, into two orders, his 32d and 33d, called *Papilionaceæ* and *Lomentaceæ;* the first, including those genera which have butterfly-shaped flowers and true legumes; the second, those in which the corollæ are regular and for the most part rosaceous, and the fruit that modified form of legume which is known as a *loment*.

(2016.) Hence, as these plants are neither universally papilionaceous nor leguminous, and as the Lomentaceæ cannot be separated from the Papilionaceæ, without violating relations more important than those which depend on the form of the corolla and

the pericarp, viz. the characters derived from the seed and its embryo, a modified distribution of the included genera founded

A. *Cathartocarpus Fistula.* Raceme of flowers and abrupte-pinnate leaf. (*a*) Flower divested of perianth, to shew the free stamens of unequal lengths. (*b, c*) Sections of the loment, shewing its spurious transverse dissepiments. (*d*) A petal. (*e*) A seed.

B *Indigofera tinctoria.* Branch with leaves and bunches of pods. (*a*) A flower separated, to shew its papilionaceous form. (*b*) Diadelphous stamens and pistil. (*c*) Contracted pod. (*d*) The pod with one of the valves removed, to shew the seeds. (*e*) A seed. (*f*) Ditto magnified and cut lengthwise, to shew the embryo. (*g*) The embryo removed.

C. *Acacia longifolia.* Branch with flowers and dilated petioles, phyllodia, instead of leaves. (*a*) A flower expanded, to shew the numerous stamens. (*b*) Calyx and pistil, the other parts having been removed. (*c*) One of the petals. (*d*) The pistil.

upon the preceding schemes, but principally upon that of De Candolle, may be more advantageous than strictly following either; and, as a change of things without a change of names is apt to induce confusion, another term, CICERINÆ, from *Cicer*, a vetch, is proposed as the collective designation of the whole. These variations in arrangement and in name will also appear further advisable, when it is considered that structure and properties are thus made more consentaneous, and that another group, the *Connara-*

ceæ, intimately allied to the vetches, but usually associated with the *Terebinthinæ*, are included in the present section.

(2017.) The *Cicerinæ* or pulse are associable into seven natural families or types, which, for convenience, may be again collected into three subsections. But, as the group is a large one, perhaps its systematic distribution may be rendered more intelligible by reducing it to a tabular form; in which references may also be introduced to the arrangements of Linneus and Jussieu.

(2018.)	Subsections.	Types and Subtypes.		
CICERINÆ or Pulse.	*Connarianæ.* Embryo straight, radicle remote or abhilose.	*Connaraceæ*		
	Lotianæ. Embryo curved, radicle near the hilum.	*Lotaceæ*	PAPILIONACEÆ.	
		Sophoridæ		
		Lotidæ		
		Hedysaridæ		
		Lathyraceæ		LEGUMINOSÆ.
		Vicidæ		
		Phaseolidæ		
		Dalbergidæ		
		Swartziaceæ		
	Mimosianæ. Embryo straight, radicle near, or hilose.	*Cassiaceæ*		
		Geoffroyidæ		
		Cæsalpinidæ	LOMENTACEÆ,	
		Mimosaceæ		
		Detariaceæ.		

(2019.) The distribution of the subtypes and types between the *Lomentaceæ* and *Papilionaceæ* of Linneus, and the relation of the whole to the *Leguminosæ* of Jussieu, are shewn by the extent of the right-hand braces.

The characters which associate them into three subsections curiously alternate in their absence and their presence. In two (the *Connarianæ* and *Mimosianæ*) the embryo is straight, while in one (the *Lotianæ*) it is curved. Again, in two (the *Lotianæ* and *Mimosianæ*) the radicle is near the hilum, while in one (the *Connarianæ*) it is remote. For the two that agree in the form of the embryo differ in the situation of the radicle, and those which agree in the relative situation of the radicle, differ in the form of the embryo. Thus,

(2020.) The *Connarianæ* are *Cicerinæ*, with straight embryos and abhilose radicles.

(2021.) The *Mimosianæ* are *Cicerinæ*, with straight embryos and hilose radicles; while

(2022.) The *Lotianæ* are *Cicerinæ*, with hilose radicles and curved embryos.

(2023.) But although thus differing in minor particulars, they all agree in the more general and important characters by which they are associated to form a section.

(2024.) Hence, differentially considered, the *Cicerinæ* are Leguminous or Lomentaceous (very rarely drupaceous) *Rosales*, with mostly exalbuminous seeds, terminal styles, perigynous (rarely hypogynous stamens) Papilionaceous or Rosaceous corollæ, (the petals occasionally abortive), the fifth lobe of the calyx anterior; and alternate, compound, impunctate, and mostly stipulate leaves.

(2025.) The *Leguminosæ* of De Candolle, which dissent from the *Cicerinæ* by the exclusion of the *Connaraceæ*, while the drupaceous *Detariaceæ* are included, differ only in their definition from the foregoing by the change of *mostly*, to '*always* exalbuminous seeds,' and the addition of the radicle being ' always next the hilum.'

(2026.) The Papilionaceæ and Lomentaceæ of Linneus have a similar common definition, and are interdistinguished by the former having leguminous fruit and papilionaceous flowers, and the latter lomentaceous fruit and the flowers nearly regular when not apetalous.

CONNARIANÆ.

(2027.) Connaraceæ. *Connarus*, *Omphalobium*, and their allies, form the single type included in the section *Connarianæ*, the characters of which are therefore identical, [§ 2018, 2020, 2028.] These plants form the transition from the last to the present section, and intimately connect the two. They are in truth leguminous, although not papilionaceous plants, but then many of the common Leguminosæ have not papilionaceous corollæ; and Dr. Brown very justly observes, that they are only to be distinguished from the Leguminosæ of authors by the situation of the radicle; for, although their regular flowers and exstipulate leaves are in general sufficient distinctions, still these are characters which are found in other types of the *Cicerinæ*, some of which, as the Cassiaceæ, have regular flowers, some, as the Mimosaceæ, synpetalous corollæ, some, as the Detariaceæ, &c. are apetalous, and, amongst the Lotaceæ, Sophora and other genera have exstipulate leaves.

(2028.) The *Connaraceæ* are shrubs or trees, with compound (pinnate or ternate) impunctate, alternate, exstipulate leaves. The inflorescence is terminal or axillary, and in racemes or panicles with evident bracteæ.

The flowers are united or polygamous by abortion. The calyx is free, persistent, pentasynsepalous, and the lobes imbricate or rarely valvate in æstivation. The torus is annular or discoid. The petals 5, free, deciduous, exserted from the bottom of the calyx, alternate with its segments, and imbricate or rarely valvate in æstivation. The stamens are subperigynous, exserted with the petals, and twice their number, those opposite the petals being shorter than those which are opposite the sepals. The filaments are usually monadelphous, but sometimes free, and the anthers dehisce longitudinally by clefts. The germen is superior, the carpels several, 5, or by abortion less, and sometimes solitary, each having a separate terminal style, and usually a dilated stigma. The ovules are 2 in each cell, collateral and ascending.

The fruit is leguminous; dehiscent by valves: and the carpels usually several, 5, or by abortion less, and the seeds erect, either in pairs or by abortion solitary, and often arillate. The albumen is rarely present; when found, fleshy. The embryo is straight, the radicle short, thick, and superior, being at the end remote from the hilum. The plumula is 2-leaved; and the cotyledons thick when the albumen is absent, foliaceous when it is present.

(2029.) Hence, differentially considered, the *Connaraceæ* are exstipulate *Cicerinæ*, with subperigynous stamens, regular flowers, twin collateral ascending ovules, and abhilose radicles.

(2030.) The *Connari* are astringent plants, and a decoction of one, the C. Africanus, is used by the negroes as a styptic to assuage the bleeding from wounds.

(2031.) *Cnestis* or scratch-wort has so been called from the pods being thickly beset with irritating hairs, like those of the *Stizolobium pruriens*. When touched they cause intolerable itching. The irritation, however, is wholly mechanical, not any poisonous secretions being instilled into the skin. The several species are handsome plants; and the pubescence of their pods, especially of *C. polyphylla*, might be substituted for cowhage.

LOTIANÆ.

(2032.) The greater part of the *Papilionaceæ* of Linneus and the *Leguminosæ* of Jussieu are included in this subsection, which is equivalent to the subordinate division *Curvembriæ* of De Candolle; and, with the exclusion of the *Swartziaceæ*, to the *Papilionaceæ* of the same writer: for the papilionaceous *Geoffroyidæ* are not comprehended in his papilionaceous group.

(2033.) The *Lotianæ* are curvembryose *Cicerinæ*, with hilose radicles and irregular polypetalous corollæ, for the most part papilionaceous, and rarely wanting.

(2034.) Three types are included in this subsection, which, from Lotus, Lathyrus, and Swartzia, the respective normal genera of each, are called the *Lotaceæ*, *Lathyraceæ*, and *Swartziaceæ*, [2018.]

(2035.) Lotaceæ. The habit of the plants included in this type is very various, some being herbs or undershrubs, while others are shrubs, or even large trees, with roundish or irregularly angled stems and branches. The leaves are alternate (rarely opposite) petiolate, and compound, impari- or very seldom abrupti-pinnate, ternate, or occasionally by abortion unifoliate. The plane of the leaflets is occasionally absent, and tendrils developed instead; sometimes the leaves are nearly or altogether undeveloped, and their place supplied by the enlarged stipules. The stipules are lateral, and very seldom wanting; and the petioles in general bicallous at the base.

The inflorescence is axillary or terminal. The flowers are united, rarely (by abortion) polygamous, collected into spikes or panicles (seldom solitary) with bracteolate peduncles. The calyx is free, formed of 5 sepals more or less cohering at the base, with a 5-cleft or toothed limb, often unequal and apparently bilabiate, the upper lip being bidentate and the lower trifid, for the odd lobe of the calyx is always anterior, and imbricate, or subvalvate in æstivation. The torus is small, annular, and covering the bottom of the calyx. The petals are usually 5, irregular, exserted from the perigynous disk, alternate with the lobes of the calyx, very unequal in size, and the odd petal is posterior. The corolla is generally apopetalous, but occasionally the petals more or less cohere by their edges. The stamina are definite, perigynous, exserted with the petals, the filaments free, monadelphous, diadelphous or triadelphous, the anthers versatile, 2-celled, or rarely by abortion 1-celled, and the pollen pulverulent. Ovarium simple, superior, opposite the anterior or lower lobe of the calyx, 1-celled, for the most part many-ovuled, but sometimes uniovulate. The trophosperm is double and nerviform, the style is simple, terminal, and proceeds from the upper margin of the ovary, and the stigma is simple likewise.

The fruit is a legume or loment, 1-celled, or, by introflexion of the upper suture longitudinally, 2-celled, or often traversed by spurious transverse dissepiments. The seeds are several or solitary, attached to the upper suture, and occasionally

furnished with a small arillus. The testa is smooth, the tegmen thin; the hilum marginal, and the micropyle very near it. The embryo is curved and exalbuminous, the radicle short, turned towards the hilum; the cotyledons accumbent, foliaceous, and during germination epigean.

(2036.) Hence, differentially considered, the *Lotaceæ*, which are the phyllolobeæ of De Candolle, are papilionaceous *Lotianæ*, with perigynous petals and foliaceous cotyledons.

(2037.) The genera associated in this type are distributable into three subtypes, which differ in the following particulars.

(2038.) The *Sophoridæ* have a continuous 1-celled legume, and 10 free stamina.

(2039.) The *Lotidæ* have a continuous 1-celled legume, sometimes but rarely sub-bilocular, from the introflexion of the upper suture, and 10 connate stamina.

(2040.) The *Hedysaridæ* have a transversely articulated legume, and the filaments of the stamina are generally connate, usually monadelphous or diadelphous, rarely free.

(2041.) Sophoridæ. The *Sophoræ* are many of them shewy handsome shrubs and trees, but are chiefly interesting from having, like *Myrospermum* or *Calusia*, another border-genus of this subtype, leaves destitute of stipulæ, a deviation

Sophora heptaphylla.

from the normal character of the *Lotianæ* and *Mimosianæ*, but which strengthens the connexion of both these groups with the exstipulate *Connarianæ*, and of all with the *Terebinthinæ*, which, although usually exstipulate, have a similar reciprocal deviation in *Canarium* of the *Burseraceæ*, the leaves of several species of which are furnished with stipules; while others, as *C. Pimela* and *littorale*, are without them. The legume in several of the Sophoræ is curiously moniliform; and two species, hence called *Pseudosophoræ*, are remarkable for having their filaments diadelphous; thus, with *S.* (or *Disemæa*) *velutina*, in which they are irregularly monadelphous, establishing a connexion with the adelphous *Lotidæ*.

(2042.) The pods of *Myrospermum* and its seeds yield a balsam, having a strong, and to most persons an unpleasant smell, but which others liken to the odour of myrrh, whence the generic name.

(2043.) The wood and bark of the *Myroxyla* afford sweet-scented resins, whence their name. *M. peruiferum* yields the balsam of Peru. *M. Toluifera*, the balsam of Tolu. *M. pubescens* also contains large quantities of a whitish balsam in the cryptæ of its bark. The bark is collected by the Indians of Puzuza, Muna, and Cuchero, and sold without extracting the resin for the purpose of perfuming clothes, rooms, &c. Plasters made of this balsam are considered efficacious remedies in headach and toothach; and the powder of the bark, as well as the balsam, an agreeable stimulant, and useful in shortening the cold stage of fevers. The legumes also abound in a whitish or yellowish resin, which, when collected in bottles, will keep fluid for years; but when received into calabashes, and exposed to the air, it hardens into the ordinary state of white balsam, as it is called in commerce.

(2044.) The balsam of Tolu, and the concrete balsam of Peru, are both obtained from the respective plants by making incisions in the bark, whence the resinous secretions flow, and are received into hollow gourds. They are so similar, that in commerce they are frequently confounded. The ordinary balsam of Peru, which is liquid and of a dark colour, is procured by boiling the small twigs of the *M. peruiferum* in water, and skimming off the supernatant balsam. These balsams are all aromatic stimuli, and more or less powerful expectorants. They enter into the composition of several syrups, lozenges, and unguents, which are favorite remedies in pectoral complaints; and the latter is an excellent digestive application to ill-conditioned ulcers, which are often difficult of treatment in cachectic persons.

The leaves of the *Myroxyla* are glandular, and are remarkable for having the pellucid spaces both round and linear.

(2045.) The *Ormosiæ* or necklace trees have so been called from (ορμος,) the use to which their beautiful scarlet seeds with black spots, are frequently put. *O. dasycarpa* is the red bead-tree of Browne; and *O. coccinea*, the scarlet bead-tree. The seeds of *O. coarctata* are similar in colour and shape to the preceding, but much smaller.

(2046.) Virgil, who required no such memorial, has had, in gratitude for much interesting botanical information recorded in his Georgics, a genus consecrated to him. The *Virgiliæ* are handsome shrubs and trees, with pendulous racemes of pink or yellow flowers. The bark of several species, as *V. lutea* and *aurea*, afford a yellow dye; and the roots of the last named have a sweet taste, resembling that of liquorice.

(2047.) The *Baptisiæ*, (from Βαπτω,) have received their name from the economical application of some of the species, especially *B. tinctoria*, which was formerly used as indigo by the dyers. The roots and leaves are antiseptic and astringent; and, according to Barton, they possess both cathartic and emetic powers.

(2048.) The *Podaliriæ*, which have been named after Podalirius, one of the mythological sons of Æsculapius, are scarcely appropriate in their dedication, for although handsome plants, none of the species are used in medicine, nor are any of them known to be possessed of active properties.

(2049.) Lotidæ. The genera included in this subtype vary considerably in their habit, port, and external structure; and, as they are numerous, it becomes expedient to take advantage of these structural variations, although some of them

are slight, in order to distribute them into minor groups. Of these secondary associations, five appear to be sufficiently distinct to be admitted as systematic districts; and from *Genista* (the broom), *Trifolium* (the clover), *Glycine* (the sweet-vetch), *Galega* (the goat's-rue), and *Astragalus* (the milk-vetch), they are called *Genisteæ*, *Trifoleæ*, *Glycineæ*, *Galegeæ*, and *Astragaleæ*. They differ in the following particulars.

(2050.) The *Genisteæ* are *Lotidæ* with stamina almost universally monadelphous, a 1-celled legume, simple or ternate, rarely pinnate leaves, and frutescent or suffrutescent stems.

(2051.) The *Trifoleæ* are herbaceous, rarely frutescent *Lotidæ*, with diadelphous stamens, a 1-celled legume, and quinate or ternate, rarely imparipinnate leaves. The corolla is also occasionally synpetalous.

(2052.) The *Glycineæ* are *Lotidæ*, with herbaceous or suffruticose, often climbing stems, variable leaves, the primordial ones being opposite, and the flowers usually blue, red, or purple, very seldom yellow. The stamina are for the most part diadelphous, and the legume 1-celled.

(2053.) The *Galegeæ* are *Lotidæ*, with herbaceous, shrubby, or arboreous stems, usually imparipinnate leaves, the primordial ones being either opposite or alternate, the stamens diadelphous, rarely monadelphous, and the legume 1-celled.

(2054.) The *Astragaleæ* are *Lotidæ* with herbaceous or suffrutescent stems, imparinnate leaves, the primordial ones being alternate; the stamens diadelphopius, and the legume 2-celled, or sub-bilocular from the introflexion of one of the sutures.

(2055.) *Genisteæ*. The *Planta Genista* or *whin*, the *Gen* of the Celts, and the *Génet* of the French, was the badge of a long race of British kings, hence called *Plantagencts*. Upwards of 80 species are included in this genus, many of which are very ornamental, but few have been applied to any important uses. The *Lignum Rhodium* is said by most persons to be the wood of *G. Canariensis*, although others doubt the fact, and refer to *Convolvulus floridus* as its source. Both plants are natives of the Canary Islands, and the wood has been named *Rhodium*, not, as some have superficially fancied, from its growing in the Isle of Rhodes, but on account of its red colour, and the rose-like odour it exhales when cut, and which escapes when burnt. The wood is bitter, and a very agreeable aromatic oil may be obtained from it by distillation; which, as well as the powdered wood, is commended as a sternutatory.

(2056.) *Genista purgans*, which grows freely on the hills in France, especially in Cevennes, is there used as a cathartic; the seeds are the part the villagers employ. The *G. monosperma* is a most valuable plant, from its power of fixing loose sands. It grows abundantly on the shores of Egypt, Barbary, Portugal, and Spain, and it converts the otherwise barren deserts into delightful gardens; its twigs, leaves, and fragrant blossoms, form a favourite and nutritious food for goats; and its smaller branches are used as cords for tying bundles. The Spaniards call both the plant and the extensive districts it overspreads *Retamas*, from its Arabic name, *Rætam*. Many other genistæ are likewise sand-fixing plants, and hence, perhaps, the final cause of their little importance to man directly as food or medicine, may be perceived, as thus they escape his ag-

gressions, and are allowed uninterruptedly to pursue their constant labours as Nature's pioneers, for the general advantage.

(2057.) *G. tinctoria*, the *woad-waxen*, or *dyer's whin*, is frequently used to dye yarn of a bright yellow colour. The whin-tops, with the flowers, are the parts employed. The unpleasant bitterness of butter and cheese are often owing to the cows being allowed to feed upon this plant, which renders their milk extremely bitter. The seeds are reputed to be both emetic and cathartic, and a decoction of the twigs to be useful in dropsy. The ashes are also said to be a valuable diuretic, and the decoction enjoys in the Ukraine a high reputation as a remedy for canine madness; but, notwithstanding the evidence adduced, its antilyssic powers seem somewhat doubtful.

(2058.) The beautiful *Laburnums* are species of *Cytisus*. The wood of the arboreous ones is much valued by cabinet-makers, and is known under the name of French or Alpine ebony. And even the shrubby stems of *C. Scoparius* are sought after, on account of their beauty when cut into veneers. Goats are fond of browsing on the herbaceous twigs of this plant, which is believed to be the *flowering Cytisus* of Virgil; and its branches, when young and tender, are often used in this country as well as in Italy, as fodder, and sometimes substituted, on account of their bitterness, for hops in brewing. They are also said to be capable of tanning leather, and of being made into a coarse kind of cloth. In our provinces, the older plants are frequently employed as thatching for cottages, sheds, and ricks. The seeds have a very bitter taste, and, as well as a decoction of the young twigs, called "broom-tops," are esteemed as a diuretic. When burned they afford a considerable quantity of vegetable alkali, upon which their medicinal properties chiefly depend; but their bitterness is also, in dropsical habits, where strength is in general greatly reduced, a further recommendation.

(2059.) The seeds of the common *Laburnum*, (*C. Laburnum*,) are bitter, and were observed by Haller to be violently emetic and cathartic; but they are now known to be absolutely poisonous. Several serious cases have occurred, both in this country and in France, from children swallowing laburnum flowers and seeds. The deleterious properties of this plant depend upon a peculiar proximate principle, discovered by MM. Chevalier and Lassaigne, and called by them Cytisine; small doses of it, when given to various animals, produce vomiting, convulsions, and death. The same principle, or a very similar one, appears to be present in the flowers of *Arnica montana*, (the Leopard's bane;) and in Asarum Europeum, (the Asarabacca.) Notwithstanding the poisonous quality of the seeds, and the purgative effects of the young shoots, the latter form a very favourite food with hares and rabbits, who, it is said, will touch no other plant while a twig of laburnum remains; and hence it is frequently sown in plantations to protect young trees, until they are large enough to resist all leporine assaults.

(2060.) *Spartium junceum*, the Spanish or rush-broom, received its name from the ancient use of its rush-like branches in the manufacture of rough cordage, and ropes are even now made from them in Spain. Its fibres are twisted into thread in Languedoc, where it is also used as green fodder for sheep. Its beautiful yellow blossoms form a favorite resort for bees.

(2061.) The Gorse or Furze, which renders our otherwise desolate heaths so beautiful, is the Ulex Europeus. Although here apparently so hardy a plant, it

is affected by climate more than many others which we regard as much more tender. Both heat and cold are inimical to it. It scarcely grows further south than Provence, and its northern range is confined, for it is unknown in Sweden and Russia. Linneus lamented that he could scarcely keep it alive in a greenhouse; and the anecdote of the transports which *Dillenius* evinced, when on coming to England he saw, for the first time, our commons glorying in its golden blossoms, is familiar to every one. It is sometimes planted as hedges; and is commonly cut for fuel, and occasionally even cultivated, where peat and coals are dear. Goats, kine, sheep, and horses, will eat the tender tops; and furze, in some places, is used as a common fodder for cattle.

Ulex Europeus and *Spartium junceum* afford two of the very rare instances known of papilionaceous flowers becoming double.

(2062.) *Ononis*, the *rest-harrow*, the different species of which are common on sterile or ill-cultivated lands, has usually been regarded as merely a troublesome weed, but the physiological history of the plant is one replete with interest; an interest, however, which it shares in common with other thorny plants, the warriors of the vegetable world. The final cause of the development of thorns, and their physiological relations, I have elsewhere discussed at length; a brief notice of the subject is all that can be admitted here.

" In barren uncultivated tracts of heath or common land thorny plants abound, *e. g.* the sloe (*Prunus spinosa*), the rest-harrow (*Ononis spinosa*), the hawthorn (*Cratægus oxyacanthus*), the buckthorn (*Rhamnus*), the cockspur-thorn (*Cratægus crus Galli*), and many others. These vegetables, when removed into gardens and cultivated with care, lose all their thorns, which so thickly beset them when wild, and bear fruitful branches in their stead; becoming, as Linneus expressed it, *tamed plants* (*Plantæ domitæ*), instead of the (Milites or) warriors, to use his language, that they were before. Wildenow was the first who explained the rationale of this metamorphosis, the first who showed that thorns are abortive buds; buds which a deficiency of nourishment prevented becoming developed into branches, and which, when the requisite supply of food is present, speedily evolve their latent leaves and flowers. But Wildenow did not perceive the beautiful adaptation of means to ends, which forms, in my opinion, by far the most interesting part of the phenomenon.

" In open barren tracts of country, the very circumstance of the sterility of the soil must prevent the production of many plants, and of those which grow, few will be enabled to perfect many seeds. It is necessary therefore to protect such as are produced from extermination, by the browzing of cattle, otherwise not only would the progeny be cancelled, but also the present generation be cut off. And what more beautiful and simple expedient could have been devised, than ordaining that the very barrenness of the soil, which precludes the abundant generation by seed, should at the very same time, and by the very same means, render the abortive buds (abortive for the production of fruit), a defensive armour to protect the individual plant, and to guard the scantier crop which the half-starved stem can bear?

" That such an armature is produced by the abortion, or partial development of buds and branches, there is abundant proof. For not only are thorns found in every stage, varying from their simple dormant or winter state, when, if opened, they contain the rudiments of leaves, through leaf-bearing spines to rigid thorns

on the one hand, or leaf-clad branches on the other; but the very organs, *i. e.* buds, which, when the plant is half-starved, are partly developed as spines, and part only as branches, become, when an abundant supply of nourishment is provided, altogether leafy branches; the buds have all been wholly developed, none have degenerated into thorns, and the plant is tamed. The *Ononis arvensis* is a familiar example immediately in point, for of it there are two well-known varieties called *O. spinosa* and *O. inermis*, from the circumstance of this being smooth and destitute of thorns, while that is covered with them. These two varieties I have often seen growing together on the same heath: the one well clad with its offensive and defensive arms, and furnished with few leaves to tempt the appetite of cattle; the other, upon or near to which a careless cow had dropped a profusion of manure, replete with leaves and blossoms, but wholly destitute of thorns, and just in such a state as to furnish an agreeable repast to the animal by which it had so richly been endowed."

The *Rest-harrow* forms a favorite food with asses, whence its name *Onorus;* and other animals will also eat it, as sheep, goats, and kine; but it is not relished by horses. The old physicians believed the O. arvensis to be endowed with powers which it is now well known it does not possess, for it was used as a specific in cases of stone, and as a remedy in delirium. The young shoots are succulent and sweet, and in some places it is esteemed as a culinary vegetable. Dioscorides says that, when pickled, it forms an agreeable dish.

Ononis Natrix is reported by Pliny to be obnoxious to snakes, whence its name, but its power of driving away those reptiles is more than apocryphal.

(2063.) *Anthyllis*, so called from the general downyness of the plants, was esteemed, or at least one species (*A. vulneraria*,) was recommended strongly by Gesner, as an application to stanch the effusion of blood from wounds. But of its application in old chirurgery the *nominis umbra* now alone remains. This, however, as well as several of the other species, form good pasturage for sheep; and Mr. Young informs us that it is very abundant in the best meadows of the Pyrenees, where, he says, it is of smaller growth than here, and less astringent.

(2064.) *Trifolieæ.* The clovers and the other herbaceous Lotidæ included in this subtypical district, are chiefly valuable as fodder, and they are cultivated to a great extent in this country under the name of *Artificial grasses;* this agricultural term having reference to their use alone, and not implying a gramineous character any more than the Gallic *sain-foin*, or the Latin *Fœnum Græcum*, both of which, like the clovers, are leguminous plants, and esteemed in different times and places as food for cattle.

(2065.) Among the most valuable of these artificial grasses are the *Medicago Lupulina*, the *Hop-medick* or *Black-nonsuch*, and *M. sativa*, the *Lucern.* The latter was much extolled by Columella and the Roman georgical writers; and it is generally agreed to be superior to clover as food for cows, not only increasing the quantity of milk and its richness in cream, but also the quality of the butter. The leaves of *M. Lupulina* are said to be laxative, and the roots are occasionally used for cleaning the teeth.

(2066.) *Trigonella Fœnum Græcum*, was so called by the Romans, on account of their having adopted, the practice of cutting and drying it for fodder, from the Greeks. It was formerly extensively cultivated in Italy, and is still occasionally to be met with on the farms in the south of Europe. The seeds are farinaceous,

but they have a strong disagreeable smell, and an unctuous and slightly bitter taste. An ounce, when bruised, will render a pint of water very thick and slimy; hence they have been used in poultices and other emollient applications, but they are now seldom employed excepting in veterinary practice.

This plant is the *hedysaron*, *ἡδυσαρον*, of Theophrastus and Dioscorides, its abominable odour being then considered a *sweet perfume*, as its old name imports; and we also learn that an oil extracted from the seeds was formerly used by the Hindus to scent their unguents.

(2067.) The *Melilots* are plants very similar to the clovers, with which they were once generically combined. *Melilotus arborea* is one of the largest species of the *Trifoleæ*, growing to the height of 15 feet. *M. officinalis* was formerly used in medicine as an ingredient in plasters, poultices, and emollient fomentations. It has a strong smell and bitter acrid taste; but, notwithstanding both, it seems to be a favourite food with cattle, and horses are so fond of it, that in Italy it is called *Trifolium caballinum;* and Ray informs us that it was at one time grown in England as food for cows and horses. The celebrated Gruyere cheese owes its peculiar flavour to the seeds and flowers of this plant, which are bruised and mixed with the curd before it is pressed. Hay made of it has a remarkable scent, and becomes more fragrant as it dries, having then some resemblance to *Anthoxanthum odoratum.* This odour was once believed to be owing to benzoic acid, but it has since been recognized as a peculiar principle, which from being also found in the *Coumarouma odorata*, has been called *Coumerin.* The flowers are much resorted to by bees, and hence the generic name of *Honey Lotus.*

(2068.) Of the clovers, *Trifolium pratense* and *repens*, are the most valuable fodder species. *T. procumbens* and *medium*, although good, are much inferior. Chalky soils are most favourable to the growth of these plants; indeed, so propitious, that many cleared grounds, especially heath and common lands, become quickly covered with them, if the surface be merely strewed over with quicklime.

T. incarnatum bears very handsome blossoms, and is grown as a garden-flower; and the roots of *T. alpinum*, which are sweet and mucilaginous, are used like liquorice in pectoral complaints.

The clover is commonly supposed to be the shamrock, and the Irish themselves, of late years, have worn the leaves of T. repens as their national badge. It would however seem, from antiquarian researches, that the true shamrock, or shamrog, is the *Oxalis acetosella*, of which more hereafter. But, although thus deprived of its Erin honours, the clover is not without traditional importance. Supernatural influence has been attributed to it; and these superstitions appear to have some connexion with the triple arrangement of its leaves. Formerly it was considered not only as "very good for cattle," but also "as noisome to witches." And (continues Johnson) in the days in which there were witches in the land, the leaf was worn by knight and by peasant, as a potent charm against their wiles.

"Woe! woe! to the wight who meets the green knight,
Except on his faulchion arm
Spell-proof he bear, like the brave St. Clair,
The holy *trefoil's* charm."

And traces of a belief in its magic power even yet remain in the almost unobserved customs of our clowns, who seek, and deem themselves fortunate if they can find, a four-leaved clover.

(2069.) *Lotus*, a name probably of Egyptian origin, has been given to several different plants. The ancients seem to have distinguished three sorts; the tree-lotus, the marsh-lotus, and the herb-lotus, the two former of which (*Zizyphus Lotus*, and *Nymphæa Lotus*), retain the original term as a specific, and the latter as a generic name.

(2070.) The *Loti* resemble the clovers in their general properties, but do not seem to be so acceptable as food to cattle. The pods of *L. edulis* are esteemed in Candia and Barbary, and those of *L. Gebelia* are eaten by the Arabs, being dressed when young, as French beans are in Europe.

The leaves of *L. corniculatus* become blue on drying, and would probably afford a dye resembling indigo, which is the produce of plants contained in the next subtypical district.

(2071.) *Glycineæ*. The 'pomme de prairie' of the Canadians, is the root of the *Psoralea esculenta*. It is very farinaceous, and affords during winter a nutritive and most acceptable food to the natives on the banks of the Missouri, where it abounds. And according to Mr. Douglas, the roots of *P. brachiata*, "though stringy, dry, and tough, are gathered and eaten by the Cree Indians, and also occasionally resorted to as food by Canadian voyagers, who call them *Navets de prairie*."

(2072.) *P. bituminosa* has, as its name imports, a very peculiar smell, resembling bitumen; but it has not hitherto been applied to any useful purpose. *P. coryliana* is considered stomachic by the Indian practitioners; and Ainslie speaks favorably of its effects in cutaneous disorders. *P. glandulosa*, a native of Chili, is reputed to be stomachic, and is there regarded as a vermifuge. It smells like rue, and is said to possess both emetic and cathartic powers. Lesson informs us that the *Araucenos* employ it to make an intoxicating liquor, which some persons have mistaken for Paraguay tea: and the roots of *P. pentaphylla*, which are aromatic and slightly bitter and astringent, have been introduced into the new French *Codex* as officinal, under the name of *White* or *Mexican Contrayerva*.

(2073.) *Indigo* is procurable from several plants, hence called indigo-bearers, but the Indigoferæ, and especially *I. tinctoria* and *Anil*, yield the chief supplies; although *argentea*, and other species, are cultivated in some places as sources of the dye. [2016 B.]

Indigo is chiefly grown in the East and West Indies, where it forms an important and very profitable article of export. Attempts have been made to cultivate it in Europe, both in the south of France during the Napoleon dynasty, and in Spain, but without success, for it not only thrives best in warm climates, but of all crops it requires perhaps the greatest extent of surface for its growth, and can therefore only be profitably raised where land is of little value and labour cheap. The comparatively small capital required for the manufacture of indigo is another temptation to its cultivation in the East Indies in preference to sugar, the outlay for the former not being above a third of that essential for the latter.

Before the English became masters of Bengal, and for the first twenty years

after their sovereignty was established, the culture and manufacture of indigo, now of such importance, was unknown as a branch of British industry, and the exports were but trifling. The European markets were then principally supplied from America. In 1783 attention however began to be directed to this business, and, though the processes pursued by the English are nearly the same with those followed by the natives, their greater skill, capital, and intelligence, gives them an immense advantage. In their hands, the growth and preparation of indigo has become the most important employment, at least in a commercial point of view, carried on in the country. The indigo made by the natives supplies the internal demand, so that all which is raised by Europeans is exported.

In the Delta of the Ganges, where the best and largest quantity of indigo is produced, the plant lasts only for a single season, being destroyed by the periodical inundations; but in the dry central and western provinces it lasts two years, one or even two *rattoon*, or offset crops, being obtained; and, owing to this circumstance, the planters in the latter situations are enabled to furnish a large supply of seed to those in the former. The seeds are sown in drills a foot apart during the rainy season, and kept free from weeds. In two or three months the crop is fit for cutting, but the plants must not be allowed to flower, otherwise the foliage becomes hard and unproductive, and it should be cut in wet weather, for if the season be too dry the stools will not spring again; hence, from these and other circumstances, such as its destruction by hail-storms, the produce is precarious. When cut the herb is steeped in vats; and, after being well macerated and the colouring matter extracted, the liquor is drawn off into other vessels, in which it undergoes the peculiar process of beating, to cause the fæcula to subside. The fæcula is subsequently collected and transferred into a third set of vats, where it remains for sometime before it is strained through cloth bags, and evaporated in shallow wooden boxes, placed in the shade. Before it is perfectly dry it is cut into small pieces an inch square, and is then packed in barrels or sewed up in sacks for sale. During the four years ending 1829, the annual exports of indigo from Bengal have averaged 9,000,000 lbs. per annum, the value of which varied, according to its quality, from 3*s*. 3*d*. to 6*s*. 6*d*. a pound.

(2074.) The I. Anil (the *Anyl* of the Arabs,) is the species chiefly cultivated in America and the West Indies. *I. Guatemala* is also sometimes grown. The plants are in perfection in two or three months after being sown, and are there observed to answer well for the manufacturer, even when full blown. They are cut with reaping-hooks a few inches above the roots, tied in loads, carried to the works, and laid by strata in the steeper, the process of manufacture not differing essentially from that pursued in the East Indies. Seventeen negroes are sufficient to manage twenty acres of indigo ground, and one acre of rich land, well planted, will, with good seasons and proper management, yield 500 lbs. of *Indigo* in twelve months; for the plants, after being cut, send out *stolones* or rattoons, and thus gives four or five crops a year.

(2075.) It appears pretty certain that the culture of the indigo plant, and the preparation of the dye, have been common in India from a very remote epoch. Pliny mentions it under the name of *Indicum*, (l. 36, c. 6), and says, when diluted with water, it produces an admirable mixture of blue and purple colours; and he gives tests by which the genuine drug might be distinguished with suffi-

cient precision. He knew also that it was the produce of a vegetable, but, as with other substances brought from afar, he was egregiously mistaken as to its mode of preparation. Nor need this be wondered at, as even at the close of the sixteenth century it was not known in England what plant afforded indigo. This we learn from "*the Remembraneer for Master T.*" who was instructed by Hackluyt "to know if *Anil*, that coloureth blue, be a natural commodity of those parts (Turkey), and, if it be a compound of an herb, to send the seed or root, with the order of sowing, &c., that it may become a natural commodity in the realm, as woad is, and that the high price of woad may be brought down." (1582.)

(2076.) Indigo, when first introduced into Europe, was used to mix with woad, the customary dye, to heighten its colour; but by degrees the quantity of indigo was increased, and woad was at last entirely superseded. It is worth while, however, to remark, that indigo did not make its way into general use without encountering much opposition. The growers of woad prevailed on several governments to prohibit the use of indigo. In Germany an imperial edict was published in 1656, prohibiting the use of *indigo* or "*devil's dye*," as the learned counsellors chose to designate it, and great care was directed to be taken to prevent its clandestine importation; because, says the edict, "the trade in woad is lessened, dyed articles injured, and money carried out of the country." The magistrates of Nuremberg went still further, for they compelled the dyers of that city to take an oath once a year not to use indigo; which practice was continued down to a very late period.

In 1598, upon an urgent representation of the states of Languedoc, and at the solicitation of the woad-growers, the use of indigo was prohibited in that province, and it was not until 1737 that the dyers of France were left to dye with such articles, and in such a way as they pleased. (Beckman.) Let not those (observes M'Culloch), who may happen to throw their eye over this paragraph smile at the ignorance of our ancestors—*Mutato nomine de te fabula narratur*. How much opposition is made at this moment to the importation of many important articles, for no better reasons than were alleged in the 16th century against the importation of indigo!

(2077.) The indigo plant, in its natural state, is innoxious; but indigo, when prepared, is a dangerous poison. The chemical changes which take place during the process of preparation are extremely curious, (Vid. Brande's Manual, ii. 464; or Turner's Elements of Chemistry, 755); when nitric acid is made to act upon indigo a new acid is formed, called the Carbazotic.

(2078.) *Ternalea* is the only species of the genus *Clitoria* which has been usefully employed. Its root is mildly emetic, and is administered in milk as a diuretic in dropsy. The seeds are purgative, and the flowers afford a blue dye.

(2079.) The roots and leaves of some species of *Glycine* are sweet, and hence the generic name. They are very ornamental plants, and two or three are useful likewise. *G. subterranea*, the Voandezeia of Madagascar, and the Mandelobi of Brazil, has tuberous roots, filled with a nutritious farina. The tubercles are about the size of a musket-ball, and are eaten in *Madagascar* and *Brazil*, as those of G. tomentosa are in the neighbourhood of Pondicherry, where they are likewise given to horses instead of oats, under the name of *Coulort*.

(2080.) *Galegeæ*. The *Goat's rue*, like many of the plants associated with it,

forms excellent fodder, and is peculiarly acceptable to those animals whose name it bears. The generic term *Galega* hints at the prevalent belief that it increases the milk in animals that feed on it.

G. officinalis once enjoyed a high reputation as an alexipharmic; and it is recorded to have been administered with great success during a plague which ravaged Lombardy. Boyle speaks of it as a cordial, in no niggard terms of praise; and *Monlien* and *Camerarius* recommend it as an efficient medicine. But it has very little either smell or taste; and its sensible properties are irreconcilable with the idea of its being a trustworthy agent in the cure of serious disease. Of this, a proof, although indirect, may be obtained from the fact that it is now used as a potherb, and eaten as a salad in Italy. In India, the root of *G. purpurea*, which is bitter, is recommended in cases of dyspepsia; that of *G. spinosa*, combined with ginger, is also prescribed by the Indian practitioners for indigestion; and *G. Virginiana* is reputed to be a powerful sudorific. *G. tinctoria*, and some other Senegal species, afford a kind of indigo. *Galega sericea* is, according to *Thunberg*, made into a paste which intoxicates fish, and is used to capture them in the Antilles. *G. toxicaria* is possessed of similar properties; and, according to *Lunan*, is used for a like purpose in India.

(2081.) The different kinds of liquorice belong to the genus *Glycyrrhiza*, so called on account of the sweetness of the roots, which abound with a mucilaginous saccharine juice, possessing a very peculiar, and to most persons agreeable flavour. Several species, as the *echinata* and *lepidota*, as well as the *glabra*, afford the drug in question; but it is chiefly procured from the latter, which has been generically distinguished by *Mœnch*, under the name of *Liquiritia*, but the differences of structure are too slight to render its segregation necessary.

(2082.) Liquorice is a native of the south of Europe, and is much cultivated in Spain, whence our chief supplies are drawn. It has likewise for many years been partially grown in England, plantations being formed at Mitcham, Battersea, Fulham, and other places in the neighbourhood of London; and formerly it was cultivated to a considerable extent at Pontefract in Yorkshire, Worksop in Nottinghamshire, and in other provincial districts. Stow informs us that the "planting and growing of *Licorish* began about the first year of Queen Elizabeth's reign." One hundred weight of the root will afford twenty-eight pounds of the extract commonly known as Spanish liquorice, which, when purified, becomes much more agreeable in flavour, and is known as liquorice lozenge. It enters into the composition of several pectoral medicines, and is used to cover the nauseous taste of aloes and other drugs; but its chief consumption is by the porter-brewers. By the analysis of Robiquet it has been shewn that the sweetness of liquorice depends upon a peculiar form of sugar, which he calls *Glycyrrhizin* or Glycion. The roots also abound in amylaceous fecula, and contain a new crystalline substance and a resinous oil, besides phosphate and malate of lime, and woody fibre.

(2083.) *G. fœtida* differs from the other species by having a very disagreeable smell; the whole plant, when bruised, exhales a fetid odour.

(2084.) *Tephrosia toxicaria*, *emarginata*, and *piscatoria*, are remarkable for their power of imparting an intoxicating quality to a large quantity of water, and the bruised leaves are used in the West Indies to intoxicate fish. The large ones recover from the effects of this inebriation when removed to other water, or when the poison is carried away by the stream, but the smaller fry generally perish.

T. purpurea is prescribed in India for dyspepsia, and *T. tinctoria* is one of the *Anils* from which the Ceylonese prepare their indigo.

(2085.) *Amorpha* is the bastard-indigo, one species of which, *A. fruticosa*, was formerly cultivated in Carolina, for the sake of the colouring matter it affords; but, as it is far inferior to the true indigo-plant, its culture has long since ceased. The genus is at present chiefly interesting, from the circumstance of the papilionaceous corolla losing its normal appearance by the abortion of the *wings* and *keel*, the *standard* being the only petal developed. This is an approach to the entire abortion which occurs in the *Detaria*, and the deformity is expressed in the generic name.

(2086.) *Nissolia quinata* (or *ferruginea*), which is a native of Guiana, exudes from its stem a reddish transparent gum that has a powerfully astringent flavour.

(2087.) The locust-tree of North America, the wood of which is so much esteemed for its hardness, strength, and durability, is a species of *Robinia*, called *Pseud-acacia* or *False Acacia*, from its resemblance in port and foliage to the true *Acaciæ*. It is a tree of rapid growth, and its timber is considered of nearly equal value with that of the oak, which it would doubtless supersede in many places were it not for its brittleness. High winds injure the trees much, so that they seldom, at least in this country, attain any great size. As trenails, gate-posts, &c. it is nearly incorruptible. The other species of *Robinia*, as *R. hispida* and *viscosa*, are very ornamental shrubs and trees.

(2088.) *Caragana* is a genus which includes several plants once confounded with the *Robiniæ; Caragan*, or *Carachina*, being the vernacular name of one of the species which is common in Tartary. The root of *C. Altagana* has somewhat the smell and taste of liquorice. The leaves of *C. arborescens* form good food for cattle, and it is said that they contain a colouring matter resembling indigo. The seeds are given as food to poultry, and its twigs are tough, and employed as cords or withies. The tough shoots of *C. frutescens* are also used instead of osiers, and *C. spinosa*, on account of its spiny branches, is cut and set in clay on the tops of the walls about Pekin, as broken glass bottles are in England, to prevent people from climbing over.

(2089.) *Piscidia erythrina* or the fish-wood, is another of those numerous plants which possess the peculiar property of intoxicating fish, of which a very interesting account is given by Dr. Hamilton, in a paper read before the Medico-Botanical Society of London, and published in their Transactions. He also gives some most important information with regard to its effects on the human frame. He says it was the bark of the root, and not the leaves and branches, as commonly reported, that he saw used for intoxicating fish, and that the roots are more powerful if collected while the plants are in flower.

" The bark of the root, previous to being used for fish-poisoning, as the sport is called, is macerated with the lees of the stillhouse, and tempered with quicklime; it is then put into baskets of a convenient size, with one of which each of the fishermen is provided: thus equipped, they embark in one or more boats, according to the size of the bay selected for the sport, and, pushing to a sufficient distance from the shore, they hold their baskets over the side of the boat in the water, and continue to agitate them till the whole of their contents is washed out, and the water has become impregnated with the intoxicating preparation, which happens sooner or later, and to a wider or narrower extent

according to the number of washers and boats, and the dimensions of the bay. In a little time the smaller fish are seen floating, apparently dead, upon the surface of the water, while the larger fish, capable of longer resisting the stupifying influence of the medicated water, swim wildly about, raising their heads above the narcotic fluid, and striving as it were to breathe a purer atmosphere; these surrender themselves an easy prey to the persons in the boats, who catch them with their hands as they float by, perfectly unresisting; if thrown, immediately after being taken, into fresh and pure seawater, there is no doubt but that, with the exception perhaps of the smaller fry, they would soon recover. Neither their flavour nor wholesomeness is in the least impaired by the manner in which they have been taken; but, from the number which are uselessly destroyed by this mode of taking fish, poisoning has been prohibited in many of our islands. The manner in which the Wonga root was used by the Carribs differs in appearance from the above, which I myself witnessed, but in principle is indisputably the same: they stuffed, as I was informed, the bellies of several small fish with a preparation of the root, and threw the baits thus doctored overboard, when they were devoured with avidity by the larger fish: these latter being stupified by the dose, became, in their turn, the prey of the icthyophagists in the boats.

"Struck with the singular and decided effect of the dogwood bark upon the fish, I was induced to investigate its properties as an internal remedy upon the human frame, and commenced, accordingly, a series of experiments upon myself with the bark, in substance, in infusion, in decoction, and in tincture; which last I found to be the only efficient and practicable mode of exhibition, since the active constituent appears to be a resin insoluble in any thing but rectified spirit, in combination with a powerful and deleterious empyreumatic oil: hence the necessity of the stillhouse lees, which contain alcohol in a highly concentrated state, in the preparation of the bark for fish-poisoning.

"My tincture was prepared by macerating one ounce of the coarsely powdered bark in twelve ounces, by measure, of rectified spirit, which I had brought with me from England, for twenty-four hours, and straining. The tincture thus obtained was of a fine honey yellow, and appeared to be fully impregnated with the active principle of the bark: it had nothing striking or offensive in its taste or smell, but, on being dropped into water, it communicated to it an opaline or milky hue, evidently from the separation of a resin; and, on suffering some of the undiluted tincture to evaporate in a glass, the sides were encrusted with a white film of the resin which remained behind. Labouring at the time under a severe toothach, which seemed to set sleep at defiance, I took towards night a drachm measure of this tincture in a tumbler of cold water, and lay down, with the uncorked phial in the one hand and the empty glass in the other, to speculate upon the manner of its operation on the system. The dose was by no means disagreeable to take, nor was its action on the mouth and throat so unpleasant as that of the bark in substance, which irritated the fauces like the Daphne Mezereum or the croton oil; but, soon after swallowing the dose, I became sensible of a burning sensation in the epigastric region, spreading rapidly to the surface, and terminating in a copious diaphoresis, in the midst of which I was surprised by a sleep so profound that I was utterly unconscious of existence from about eight o'clock at night till eight the following morning, when I awoke free from pain of every description, and found myself still grasping the uncorked phial in one hand,

from which not a drop had been spilled, and the empty glass in the other. No unpleasant sensation followed, as is usually the case after opiates, from the exhibition of what was perhaps a needlessly large dose; nor did a friend, whom, though in perfect health, I persuaded to repeat my experiment in his own person, suffer the slightest inconvenience from an equally full dose: his only observation was, that he never had slept so sound in his life as he did that night. I next tried its efficacy as a topical application in cases of carious teeth, introducing a pledget of cotton impregnated with the tincture into the cavity, and never knew an instance of a return of pain after this application. I was next desirous of comparing its effects upon animalculæ in water with those of the tincture of opium: for this purpose I took, in two separate wine-glasses, equal quantities by measure of water, filled with the lively young of the mosquito, adding to the water in one glass a sufficient number of drops of the Tinctura opii to stupify the animalculæ, which fell in a mass to the bottom; I then dropped into the other an equal number of drops of the Tinctura piscidiæ, with a similar result. Next, taking the first glass, and carefully decanting the water without disturbing the insensible mass of animalculæ, I poured upon them fresh portions of pure water, previously filtered, in order to prevent confusion; upon which they revived, and swam about as actively as if nothing had happened. I treated those in the glass to which the dogwood tincture had been added, but without the slightest effect: the most frequently repeated affusions of pure water were not of the least avail; the animalculæ were truly dead, and thus furnished a conclusive proof of the superior potency of the dogwood over the opium tincture, in equal quantities."

The root-juice is used to poison the arrows with which birds are shot, in the Antilles. The bark is astringent, and is said to be an effectual remedy for the mange in dogs; it is also reputed to possess tanning properties.

This *Piscidia* is one of the best timber trees of Jamaica; its wood is coarse, but heavy, resinous, and almost imperishable, lasting equally well in and out of water; hence it makes excellent piles for docks and wharfs.

(2090.) *P. Carthagenensis* very closely resembles the preceding species in its properties and powers.

(2091.) The bladder or false sennas are different species of *Colutea*. The leaves of *C. arborescens* and *C. cruenta*, which are common garden shrubs, are slightly laxative. They have been recommended as a substitute for true senna, but are more frequently used to adulterate the genuine drug, which is an inexcusable fraud, as they do not possess above an eighth part of its powers, an ounce of the one being only equal to a drachm of the other. The seeds are said to be emetic in the dose of ℈ij. or a drachm.

(2092.) *Astragaleæ*. *Phaca*, (φακη, from φαγω, to eat,) the Greek name for the lentil, has been inappropriately given in modern botany to a genus of plants which, although not hurtful, can scarcely be regarded as esculent. The only instance in which they serve as human food, is the substitution of the roasted seeds of *P. Boetica* in Hungary for coffee, and a very indifferent surrogate they are.

(2093.) *Astragalus*, the star-milk-vetch, is a very large genus, comprehending upwards of 250 different species, most of which are handsome ornamental plants. The seeds of a few, as of *A. Boetica*, are, like those of *Phaca Boetica*, roasted and ground, in some places, instead of coffee, for which purpose the plant is culti-

vated in Sweden and Siberia. The seeds of *A. Cicer* are given as food to children and forage to horses. The roots of *A. aboriginorum*, which are long and yellow like liquorice, are in Arctic America, where it is a native, collected as an article of food by the Crees and Stone Indians; and the roots of *A. Ammodytes*, which are also sweet, are used in Siberia instead of liquorice. The leaves of *A. glycyphyllus* have a sweetish taste when first chewed, which soon changes to a nauseous bitter; it is hence, although indigenous here, left untouched by cattle.

(2094.) *A. gummifer* and *Creticus*, as well as *A. verus*, and perhaps some other species, afford that peculiar gum denominated Tragacanth, and which chemical analysis has shewn to consist almost wholly of pure *Cerasin*. The power of this gum to render water viscid, is about twenty-four times as great as that of gum-arabic. Medicinally it is employed as a demulcent, and it enters into the composition of various lozenges, and other confectionery.

(2095.) *A. tragacanthoides* is esteemed among the Kalmucs as a febrifuge; and a decoction of *A. exscapus* is said to afford great relief in the distressing nocturnal pains of chronic rheumatism, and those which accompany certain other cachectic disorders.

(2096.) *Hedysaridæ.* Although far less multitudinous than the genera comprehended in the last subtype, those which are included in the present are numerous; and hence, as they are distributable into three well characterized subtypical districts, it is expedient to arrange them in these minor groups, which, from the most important plants contained in each, may be called the *Coronilleæ*, *Hedysareæ*, and *Alhageæ*, respectively, [§ 2040.]

(2097.) The *Coronilleæ* are sertulate *Hedysaridæ*, with diadelphous stamens, and round or compressed legumes.

(2098.) The *Hedysareæ* are racemose *Hedysaridæ*, with compressed legumes.

(2099.) The *Alhageæ* are racemose or spicate *Hedysaridæ*, with legumes almost round.

(2100.) *Coronilleæ.* The *Coronillæ*, so called on account of their flowers being disposed in sertula or coronets, are handsome and freely flowering plants.

C. Emerus, the scorpion-senna, is a beautiful shrub, and its leaves, which are laxative, are sometimes used instead of senna. *C. varia* is eaten greedily by cows and horses, and it has been proposed to cultivate it as fodder, but its bitterness may prove an objection. Some cases have been published which attribute deleterious properties to this Coronilla; M. Lejeun, however, who made a series of experiments, so far from believing it to be at all poisonous, recommends it as a valuable diuretic, and has published some cases of dropsy which he cured by its administration.

(2101.) *Hippocrepis*, the horseshoe-vetch, and the other genera of the Coronilleæ, are ornamental plants, but have not been applied to any important useful purposes.

(2102.) *Hedysareæ.* The *Æschynomene* of Pliny was a plant described by him as withdrawing its leaves when touched, but what sensitive plant he referred to is now unknown, and the name has been given to a genus, one species of which, Æ. sensitiva, is, like the original, endowed with a very peculiar degree of irritability, the leaves collapsing on the slightest touch.

(2103.) *Æ. aspera* and *paludosa*, and perhaps some other species, afford the delicate substance known here under the name of rice-paper. The sheets are

formed by cutting the beautifully cellular structure of the stem into thin laminæ with a very sharp knife, and these are subsequently flattened and tinted of various colours. Dr. Livingstone first introduced 'rice-paper' into Europe not quite thirty years ago; and a bouquet of flowers made of it by Miss Jack, an artificial florist of celebrity, and presented to the late Princess Charlotte of Wales, was so exceeding beautiful, and for its novelty so much admired, that it procured for the artist the royal gift of 70*l.* The plant, which is called *Kath-sola*, is of low growth, and the stem seldom exceeds $2\frac{1}{2}$ inches in diameter; bundles of it are brought to the Calcutta markets in a green state. The Hindus make artificial flowers and various ornaments of it to decorate their shrines. In India hats of almost inconceivable lightness are made of the *Solah* plant. The fishermen also use it for floats, not only for their nets but for themselves; and with a bundle under each arm they proceed to spread their toils, and work in the water without a boat.

(2104.) A decoction of *Æ. aspera* is used in India as a remedy in dropsical complaints. The bark of *Æ. grandiflora* is esteemed as a febrifuge. In Amboyna and Java, where it is called *Turi*, its flowers are eaten both raw in salads, and cooked as potherbs. Its leaves are used instead of tea by the Malays, who also eat its seeds, which are as large as haricots, with meat; this being one of the very few instances in which the seeds of the Lotaceæ afford food to man. A resinous juice which is obtained from its stem is used by the Chinese as varnish.

(2105.) The *Chunda-Borrum* of the Hindus, the *Desmodium* (or *Hedysarum*) *gyrans* of botanists, is, as Linneus, who described it in his supplement, has well observed, "a wonderful plant, on account of its singular motion, which is not occasioned by any touch or irritation, or movement in the air, as in *Mimosa*, *Oxalis*, and *Dionæa;* nor is it so evanescent as in *Amorpha.* No sooner (continues he) had the plants raised from seed acquired their ternate leaves, than they began to be in motion in every direction; this movement did not cease during the whole course of their vegetation, nor were they observant of any time, order, or direction: one leaflet frequently revolved, while the other on the same petiole was quiescent; sometimes a few leaflets only were in motion, then almost all of them would be in movement at once; the whole plant was very seldom agitated, and that only during the first year. It continued to move in the stove during the second year of its growth, and was not at rest even in the winter." The irritability of this *Desmodium* is never so great, even in our best houses, as it is said to be in its native climate, and its motions here are very seldom so lively as those described by Linneus. Warmth appears essential, for the movements are always the most observable when the heat is greatest; that they are not attributable to the sun's rays, nor to any currents of air, is shewn from the fact that the plant loves the shade, and that the motion is most evident when the stove is closed, and the atmosphere quite still. These movements have more the semblance of spontaneity than any others that have been observed in the more perfect plants; for the leaflets, if held quiet between the fingers for a short time, and their movements thus prevented, are said immediately on their release to revolve with accelerated speed, as if to make up for the time lost during the forcible interruption. Hence, by some physiologists, this group, containing *Desmodium* and the *Mimosas*, has been approximated to the animal kingdom, in their several schemes of arrangement.

(2106.) *D. erythrinæfolium*, which is a native of South America, is there esteemed a valuable medicine in dysentery, as well as in hæmorrhages, and other fluxes. The root is the part employed.

(2107.) The *Hedysarum* of Theophrastus is believed to have been the Fenugreek, the strong smell of which was then thought to be an agreeable perfume. The name is, however, now given to a very different group of plants, including the French honeysuckles of our gardens, and the false sainfoins of Southern Europe. In Calabria *H. coronarium* grows wild in great luxuriance, nearly four feet high, and affords excellent food for horses and mules, both when green and made into hay; and Orbeck says he saw great bundles of it brought to Cadiz as fodder for cattle. *H. frutescens*, which is a very handsome plant, is grateful to horses, and it is also extremely useful in fixing loose sands. Gmelin says that the roots of *H. alpinum* are resorted to in Siberia to increase the appetite, and those of *H. lineare* are esteemed in Cochin-china as an excellent stomachic. And Ainslie informs us that the roots of H. sennoides, which are sold in the bazaars in India, are stimulating, and are administered by the native physicians in fevers, and that a liniment is made with the powdered bark of the root mixed with oil, which is used in cases of lumbago and paralysis.

(2108.) *Onobrychis*, the sainfoin, once associated with Hedysarum, now forms a distinct but contingent genus. The name refers to one of the species, *O. sativa*, being a favorite food with asses: and it is grateful not only to them, but to most other cattle. Sainfoin is peculiarly fitted for chalky districts; and its especial value is, that it may be grown on soils unfit for being constantly under tillage, and which would yield but little if laid down in grass. This is owing to the long and descending roots that will penetrate and thrive in the fissures of rocky or chalky substrata, which other artificial grasses could not reach. The roots of this plant have been known to be from ten to seventeen, and even upwards of twenty feet long. Arthur Young says that upon proper soils no farmer can sow too much of it, and in *The Code of Agriculture* it is pronounced to be "one of the most valuable herbage plants we owe to the bounty of Providence:" the other species also yield good fodder, but they are seldom grown.

(2109.) *Alhageæ*. *Alhagi Maurorum* is the Algul or Aghul of the Moors and Arabs. This plant is a native of Egypt, Syria, Mesopotamia, and other Eastern countries; Sir George Wheeler found it at Tenos, and Tournefort both in Armenia and Georgia. The leaves and branches of the Algul are thickly covered during warm weather with a saccharine exudation, which is called Syrian, or sometimes Hebrew manna. This exudation at first is soft, and resembles drops of honey, but it soon thickens into solid grains about the size of coriander seeds. Hence some persons have supposed it to be the manna with which the Israelites were fed in the Wilderness, and the Arabians have a tradition that the manna of Moses fell from the clouds upon this plant. Such an opinion is, however, contrary to the recorded fact, that it appeared alone upon the rocks and the sand: as well as from the question which the Israelites asked upon its first appearance, (*man?*) *what is it?* whence it is supposed to have derived its name.

(2110.) A similar exudation is found upon *A. camelorum*, a native of the desserts of Tartary and Iberia, which is called Caspian manna. The leaves of the plant afford in such arid tracts an acceptable food for camels.

(2111.) LATHYRACEÆ. Although differing in several important particulars, the genera associated to form the present type are so similar in many respects to

those included in the preceding, that the two have been usually combined, and their distinction is not attended to, even by writers who have separated the not more different *Cassias* and *Mimosas*. An important circumstance has, however, been noted by De Candolle, with regard to the general properties of the plants comprehended in these two groups; viz. that while the seeds of the *Lathyraceæ* are generally esculent, and afford abundance of nutritious food to man, those of the *Lotaceæ* are as generally not eatable, scarcely any being ever employed as food. Such a striking diversity in economical properties renders their systematic demarcation desirable; and, as it appears to be closely connected with the peculiar development of the seed-lobes, which in the one group are thin and foliaceous, while in the other they are thick and fleshy, this structural peculiarity is admitted as the chief differential character, both to associate the genera, and to segregate the types. The *Lotaceæ*, on account of their foliaceous cotyledons, have been called *Phyllolobeæ* by De Candolle; and the same botanist terms the *Lathyraceæ Sarcolobeæ* upon similar principles, but for the contrary reason.

Other secondary differences are also observable between these two contingent types: and which will be evident on comparing their respective definitions and the subsequent illustrations. Thus it will be found that the cotyledons of the *Lotaceæ* or *Phyllolobeæ* are epigean; that is, they rise above the ground during germination, and assume the appearance and functions of leaves: while those of the *Lathyraceæ* or *Sarcolobeæ* are in general hypogean, that is, they remain, during the growth of the plant, frequently below the ground; and when they are raised above the surface, they are at once recognized by their thick fleshy structure and non-foliaceous form. Furthermore, the *Lathyraceæ* are much more constantly herbaceous than the *Lotaceæ*, very few of the former, in comparison with the latter, being shrubs or trees.]

(2112.) The *Lathyraceæ* are chiefly herbs or herbaceous plants, seldom shrubs, and still more rarely trees. Their mature leaves are alternate, compound, pinnate, occasionally by abortion unifoliate, the folioles sometimes converted into cirrhi, and the stipulæ lateral.

The inflorescence is variable, the flowers being disposed in racemes, spikes, or panicles, but seldom solitary.

The flowers are united, the calyx free, penta-synsepalous, unequally lobed, and generally imbricate in æstivation, the fifth or odd lobe being anterior or distant from the axis.. The torus is small, and the corolla papilionaceous. The petals 5, perigynous, exserted from the annular disk, the fifth being posterior. The stamina are exserted with the corolla, connected by their filaments, diadelphous, or occasionally monadelphous, the anthers versatile and 2-celled, or 1-celled by abortion; and the pollen pulverulent. The germen is simple, superior, 1-celled, and opposite the lower lobe of the calyx. The placenta is double, 1 or many-ovuled, the style terminal, and the stigma simple.

The fruit is a legume or loment, 2-valved, 1-celled, with sometimes spurious transverse dissepiments, and either dehiscent or indehiscent. The seeds, usually many, sometimes few or solitary, are exalbuminous, with a smooth testa and thin membranaceous tegmen, a marginal, often linear hilum, and approximated micropyle. The embryo is curved, the radicle short, the cotyledons accumbent, thick, and fleshy, and often hypogean during germination.

(2113.) Hence, differentially considered, the *Lathyraceæ* are curvembryose

Cicerinæ, or *Lotianæ*, with papilionaceous flowers and sarcolobous seeds; the cotyledons being fleshy, and often hypogean during germination.

(2114.) The genera associated to form this type are distributed into three subtypes, called, from *Vicia*, *Phaseolus*, and *Dalbergia*, the *Vicidæ*, *Phaseolidæ*, and *Dalbergidæ*.

(2115.) The *Vicidæ* are herbaceous *Lathyraceæ*, with pinnate, and usually cirrhose or setose leaves, diadelphous stamens, a continuous legume, the embryo having the radicle curved inwards, and thick fleshy hypogean seed-lobes, unchanged during germination, and remaining within the testa.

(2116.) The *Phaseolidæ* are *Lathyraceæ*, with herbaceous, but chiefly shrubby, though sometimes arboreous stems, the stamens diadelphous, or rarely monadelphous. The legume continuous dehiscent, usually subdivided by transverse membranous septa, but not articulated, the radicle bent in above the fissure of the seed-lobes. The cotyledons thick, fleshy, and unchanged during germination, but bursting through the seed-coats, and often epigean. The primordial leaves opposite, the mature ones either pinnate or palmate.

(2117.) The *Dalbergidæ* are shrubby or arboreous, not herbaceous *Lathyraceæ*, with impari-pinnate leaves, occasionally becoming ternate or unifoliate; the stamina variously connected, the legume 1-2-3-seeded and indehiscent; and the embryo with the radicle bent back upon the edge of the fleshy cotyledons.

(2118.) *Vicidæ*. *Beans*, *Peas*, *Vetches*, and *Tares*, all of them bearing edible, and none having poisonous seeds, are included in this subtype; and their economical importance and ancient repute may be surmised from the fact, of several noble Romans, such as *Cicero*, *Lentulus*, *Piso*, and *Fabius*, having borne the *Bean* (Faba), the *Pea* (Pisum), the *Lentil* (Lens), and the *Chich*, as family names. Ancient agnomina, it is however confessed, like modern nick-names, were often capriciously attached; and tradition states that one of Tully's ancestors was called Cicero, on account of having a tumor resembling a chich-pea on his nose.

(2119.) *Cicer*, the *Chich*, not Chick-pea, is a native of the south of Europe, but it does not bear our climate well, and scarcely ripens even in the latitude of Paris. In former times it was a common article of diet in Greece and Italy, and has been thought to have been considered a wholesome and very nutritious food. Of this opinion its name *Cicer*, said to be derived from κικυς, force or strength, is adduced as evidence. But the correctness of such an etymology is more than doubtful, as the Greek name for the Chich is ἐρέβινθος: and the inference sought to be established, viz. that Chiches were esteemed as food, appears still less probable, when it is remembered that poverty was implied by the Roman satirist in the words *Ciceris emptor*.

(2120.) The common, or *Ram's-head Chich*, is the *C. arietinum*, so called from a fancied resemblance of its unripe seeds to the head of a ram. In the south of Europe, and in the Levant, Chiches are still cultivated as food, and eaten both raw and boiled; and the French prefer them to haricots, when dried for winter use, as the seed-coats are less tough, and the nucleus remains entire in their *bouilli*. In hot climates and seasons an acid exudation is found upon the *Chich-pea*, which, Heyne says, is in India made into a refreshing beverage.

(2121.) *Faba vesca*, (*F. vulgaris* or *Vicia Faba*,) is the common bean, the two subspecies of which, *F. hortensis* and *F. equina*, are well known as the garden

and field, or horse-beans; of each of these there are several varieties, differing in the size and shape of the seeds, the growth of the plant, the colour of the flowers, and the seasons of maturity, which deviations are taken advantage of by scientific gardeners and farmers to ensure a succession of culinary vegetables, and to suit the various soils of different districts.

(2122.) The *Windsor*, the *Sandwich*, the *Magazan*, the *Spanish*, and the long-podded, are among the best of the garden varieties; and the flat Essex, and French tick-beans, and the common horse-bean, for field culture.

(2123.) The bean is a very nutritious vegetable, and forms excellent food for hard-working horses: it is also used for fattening hogs. A bushel of beans is said to yield 14 lbs. more flour than a bushel of oats. A thousand parts of bean-flour were found by Sir Humphry Davy to contain 750 parts of nutritive matter.

(2124.) It has been said that Pythagoras religiously abstained from eating beans, and forbad his disciples to feed upon them. Many speculations have been adventured as to his reason for such an interdiction. Some persons affirm that he believed the bean to be the retreat of the soul after death; and there were many superstitions formerly connected with this seed, which was by some nations consecrated to the gods. Others suppose that the prohibition was founded merely on sanatory principles, and that *Pythagoras*, like *Hippocrates*, conceived that beans were unwholesome, and weakened the eyesight. Even in the present day, it has been observed that mental alienations are more frequent during the blossoming of the bean than at other seasons. A circumstance, however, explicable from the excessive summer heats which about that season usually occur, and not attributable to the bean, although its black* flowers were supposed by the signature physicians to be a prophetic mourning for the maladies to ensue. Other commentators, however, and with more seeming probability, affirm that when Pythagoras said "*abstain from beans*," he merely intended to restrict his disciples from intermeddling in political affairs; for, it is well known that votes were formerly given by beans: and vestiges of this practice, at least in words, remain with us to the present day.

(2125.) Tares and Vetches, which afford abundance of nutritious food for cattle, are different species of *Vicia*. *V. sativa* is the one here most commonly cultivated. In Germany, *V. Narbonensis* and *V. serratifolia* are grown; but *V. sepium* and *V. biennis* have been recommended to the attention of the farmer. Vetches are seldom allowed to ripen their seeds, being in general eaten as a green crop; and the seeds, when ripened, are now only used for sowing or for feeding pigeons; but formerly, as Ray informs us, they were mixed with oats. Tare crops are of such use and importance, that, as Young observes, "not one-tenth of the stock could be maintained without them. Horses, cows, sheep, hogs, all feed upon them; and hogs are soiled upon them without any other food. The *V. Sativa* maintains more stock than any other plant whatsoever. Upon an acre, Davies kept four horses in much better condition than upon five acres of grass. And upon eight acres he maintained twelve horses and five cows for three months. No artificial food is equal to this excellent plant." Don very justly adds, "this statement must be coupled with the usual produce of turnips,

* The dark spot in the centre of the bean blossom, is perhaps the nearest approach to black that occurs in any flower.

in Sussex ten or fifteen tons per acre; hence the superiority of tares to every other green crop." And furthermore, as another great advantage, *Professor Thaers* observes, "when cut green, tares draw no nourishment from the soil whatever, while, made into hay, they afford a fodder preferred by cattle to pea-straw, and more nutritive than hay, or any other herbage."

(2126.) The Lentil (*Ervum Lens),* is another of the pulse which has been esteemed as human food from a very high antiquity. Lentils, when boiled, readily dissolve into a pulpy mass of a chocolate colour; and we learn that it was for a mess of this '*red pottage*' which Esau, thence called Edom, sold his birthright. In Egypt and Syria they are parched over the fire in pans, and sold commonly in the shops, being considered by the natives the best food to be taken on long journies. Three varieties of Lentil are cultivated in Italy, France, and Germany; and the use of this seed is very common on the Continent, especially by the Roman Catholics during Lent. Lentils are also imported to London from Hamburg for the use of cooks, who prize them as an ingredient in soups and sauces.

(2127.) The seeds of *E. Ervilia* are said, by Vallisneri, to be unwholesome as human food, and to produce weakness in the legs both in men and horses, when their flour is either made into bread or mixed with oats. This statement, however, wants confirmation, as the same thing was reported of *E. hirsutum*, and even of *E. Lens,* but with regard to both the latter, it has been disproved by direct experiment.

(2128.) The pea (*Pisum*) is a well known culinary vegetable; of one species of which (*P. sativum*) there are many varieties cultivated in our gardens for table use, and others in fields, as food for cattle; but the latter, or grey peas, are by some botanists considered as specifically distinct, and called *P. arvense*.

(2129.) The Charlton, the Marrow-fat, the Prussian-blue, and the Sugar-peas, are among the best of the garden varieties. The pods of the latter are so tender that they may be boiled entire, and eaten as French-beans. The pea has been long cultivated in this country; but, common as they now are, they were in Elizabeth's time so scarce, that Fuller says they were then in general brought from Holland, and were "fit dainties for ladies, they came so far and cost so dear."

(2130.) The grey or field peas are grown extensively for feeding pigs and pigeons, and for splitting as an ingredient in soup. A bushel of peas will yield from 18 to 20 lbs. more flour than a bushel of oats, and 6 lbs. more than a bushel of beans. Sir H. Davy found by experiment that 1000 parts of pea-flour yield 574 parts of nutritive or soluble matter. Pea haum or straw, either green or dry, is reckoned as nourishing as hay, and considered an excellent food for sheep.

(2131.) *P. Americanum*, the Cape Horn pea, was brought to England by Lord Anson's cook: it afforded great relief to the sailors during that adventurous navigator's voyage, but is inferior to all our cultivated varieties.

(2132.) The sea pea, *P. maritimum*, is interesting from the legend still rife in Suffolk, that it sprang up spontaneously on the coast in 1555, in a time of great scarcity. The miraculous arrival of these peas is mentioned both by Stow and Camden, and these historians supposed them to have sprung from the cargo of some vessel wrecked on the coast and washed ashore; but the sea-pea is a

distinct species, probably indigenous, and only first made use of in a time of dearth. The seeds are bitter and unpalatable.

(2133.) Lathyrus (the λαθυρος of Theophrastus) was once considered to be possessed of aphrodisiac powers, but these are now discredited, and the different species are chiefly valued as ornamental plants, being great favorites in gardens, and known as sweet-peas, everlasting-peas, Tangier-peas, &c.

Lathyrus sativus is commonly sown in Switzerland as food for horses; and in several parts of the continent a white light pleasant bread is made from the flour of its seeds. But in the seventeenth century such dreadful effect followed the consumption of this bread, that the use of it was forbidden by an edict of George, Duke of Wirtemberg, in 1671, and this being disregarded, was again enforced by two other edicts of his successor, Leopold, in 1705 and 1714.

Mixed with an equal quantity of wheat-flour this meal makes good and wholesome food, but bread made of it entirely brings on in those who eat it for a continuance a surprising rigidity of the limbs, so that the muscular power is lost, and this without any hope of restoration. These symptoms, it is said, usually appeared on a sudden, and without any previous pain; although they were sometimes preceded by a weakness and disagreeable sensation about the knees. Swine fed on this meal also lost the use of their limbs, but grew very fat lying on the ground. A horse fed for several months on the dried herb was said to have his legs perfectly rigid. Kine are reported to grow lean on it, but sheep not to be affected. Pigeons, especially young ones, lose the power of walking, by feeding on the seeds. Poultry will not readily touch it, but geese eat it without any apparent damage. (*Duvernoy.*)

(2134.) The poisonous Lathyrus of Barbary, the *L. semine punctato* of C. Bauhin, is only a variety of the foregoing, for in the Italian crops black seeds striped with white are found as in the African pulse, and probably the deleterious properties of this seed may be owing to occasional disease; for Fabroni tells us that, although the government of Florence cautioned the people, in 1786, against the use of this Lathyrus, on account of swine having lost the use of their limbs and become pitiable monsters, by being fed on it exclusively, still he admits that the peasants eat it boiled or mixed with wheat flour, in the proportion of one fourth, with impunity. (*Loudon.*)

(2135.) The seeds of L. hirsutus are eatable when cooked, but they have an unpleasant taste, and in doses of two ounces or more, become too laxative to be an agreeable food.

(2136.) The roots of L. tuberosus bear nut-like tubercles resembling those of the true earth-nut; the plant is cultivated in Holland, and the tubers are sold in the markets there under the name of *Macusson*. They are nutritious, have the flavour of a chesnut, and Gmelin says they are esteemed as food in Siberia.

(2137.) *Lathyrus Aphaca*, and *Nissolia*, are remarkable for the abortion of their leaves, or rather, for the suppression of the leaf-planes; their place being supplied by the enlarged stipules or dilated leaf-stalks. Hence these plants are usually described like the curious Acaciæ of New Holland, which the latter closely resembles in the economy of its foliage, as being leafless: but such a description is scarcely correct, as one part of the leaf is greatly developed, although another is suppressed. In *L. Aphaca* the stipules are very large, the lamina being abortive,

and the petiole converted into a tendril in the adult plants, but, like the *Acaciæ* above referred to, in seedlings the leaves are occasionally developed. In *Lathyrus Nissolia*, where not only the expansion is suppressed, but the stipules also either very small, or more often altogether absent, the petiole is developed into a grass-like phyllodium. The *Lathyri* hence afford an interesting series of foliar evolutions, in which the several parts of the leaf, viz. *plane*, *stalk*, and *stipules*, are alternately suppressed, or inordinately developed. In *L. sessilifolius* the petiole is altogether absent, the stipules and expansion being both evolved. In *L. Aphaca* the stipules are inordinately developed to the abortion of the plane, and the petiole converted into a tendril; while in *L. Nissolia* no vestige of *lamina*, not even a tendril, is developed, and the stipules are minute or wanting, the petiole being alone evolved, and that to such an excess that it becomes a phyllodium.

The seeds of *L. Aphaca* are said to be unwholesome, and, if eaten in any quantity, to cause intense headach.

(2138.) Our *Orobus*, or bitter-vetch, is certainly not the ορoβoς of the ancients, as that was some plant then used for fattening cattle, for which none of the species of the present genus are remarkable. O. tuberosus has tuberculate roots, which in Scotland are much esteemed. The highlanders dry and chew them, to give a better relish to their whiskey; and they are reputed to have the power of allaying, for a long time, the pangs of hunger and thirst. In Breadalbane and Ross-shire these roots are bruised and steeped in water, and an agreeable liquor made by fermentation. They have a sweet taste resembling liquorice, and have in times of scarcity been substituted for bread. They are nutritious, and when well boiled they form a pleasant vegetable food. In Holland and Flanders they are roasted and eaten in the same manner as chesnuts.

(2139.) *Phaseolidæ.* The kidney-beans, including the haricot, the white and scarlet runners, and many other species, are referred to a genus which, from the boat-like form of the seed-vessel, has been called *Phaseolus*. The plants are in general of easy culture, growing on poor light soils, but are intolerant of cold, the seedlings being injured, and the leaves of the mature bines being turned black, on the first accession of frost. In England kidney-beans are for the most part eaten when quite young, both the pod and seeds being sliced, and either boiled or pickled; but on the Continent the ripe seeds are principally used under the name of haricots; and they enter into the composition of soups, and many other dishes. They are relished by all classes; and, on account of their plenty and extremely low price, they form a considerable proportion of the food of the poor throughout France during the winter, and in the provinces during three parts of the year.

It would appear, from the analysis of Einhoff, that the kidney-bean is the most nutritious of all the pulse, as 3840 parts are said by him to afford 1805 parts analogous to starch, 857 of vegeto-animal matter, and 799 parts of mucilage.

(2140.) Many other species besides the *vulgaris* and *multiflorus* (the common haricot and scarlet beans), afford esculent seeds which are esteemed as food in different countries, such as *P. lunatus* in Cochin-china and Hindustan, *P. aconitifolius* in Pondicherry, *P. Tunquinensis* at Tonquin, and *P. Max* and *Mungo* in Persia and the East Indies.

(2141.) Dr. Hamilton informs us that in India the seeds of *P. trilobus* are esteemed as a febrifuge.

(2142.) The fleshy roots of *Apios tuberosa* are edible, and the pods and the

seeds of *Macranthus Cochin-chinensis* are eaten in the countries where it grows, as the haricots are with us.

(2143.) The seeds of *Abrus precatorius* are well known as prayer-beads in Europe, their trivial name referring to their common use when strung as rosaries. In Egypt these seeds are eaten like other pulse, but they are hard and very indigestible, whence the opinion probably arose that they are absolutely deleterious. The roots of Abrus are sweet, have the flavour of liquorice, instead of which they are used in the West Indies, where the plant is called wild liquorice by the colonists.

(2144.) The scarlet seeds of *Rhyncosia precatoria* are also strung as rosaries, like those of Abrus.

(2145.) *Sooja* is the name of a Japanese sauce, prepared from the seeds of a species of Dolichos, now made into a distinct genus, and called *Soja hispida*. The *Soja* of Japan is preferred as a sauce to the *Kitjap* of China; both, however, are imported into England in large quantities, and are here known as *Soy*. In bond it is worth about 6*s*. a gallon; but, after it has been adulterated, it is sold at 3*s*. and upwards a pint. The Japanese make a soup of the seeds, called *Miso*, which is one of their most favorite and common dishes, the natives eating of it three times a day. The Chinese also have a populai dish made of these seeds, called *Teu-hu* or *Tau-hu*, which looks like curd; and, though insipid in itself, yet with proper seasoning is rendered agreeable and wholesome.

(2146.) Several species of *Dolichos* bear eatable pods and seeds, such as *D. hastatus*, *D. Catiang*, *D. Sinensis*, *D. Lubia*, *D. tuberosus*, and others; the roots of the last named are fleshy and esculent, as well as its seeds, and it is esteemed as a vegetable food in Martinique.

(2147.) *Lablab vulgaris* and *Nankinicus*, *Pachyrhizus angulatus* and *trilobus*, and *Psophocarpus tetragonobolus*, are all modern genera, made up of species separated from the old genus *Dolichos*, and possessing similar properties; the pods and seeds of the first two being eaten in Egypt and in China, as well as in the East and West Indies, where they are cultivated as food. The fleshy roots of the *Pachyrhizi*, which resemble turnips, are esteemed in the East Indies and in China; and the latter is cultivated in the Mauritius for the sake of its seeds, which are there used as peas in Europe.

(2148.) *Mucuna* (so called from *Mucuna-guaca*, the Brazilian name of one of the species,) is another offset of *Dolichos*. The several species of cowitch or cowhage are here collected, and the species are distributed into two subgeneric groups, the one called *Zoophthalmium*, from the resemblance of the seeds to the eyes of an animal; and the other *Stizolobium*, on account of the stinging hairs with which the pods are covered.

(2149.) *Z. urens* is the burning cowitch of the West Indies and South America. *S. pruriens* is the common cowitch that is imported for officinal purposes; a decoction of its pods is said to be powerfully diuretic, and a vinous infusion of them is administered in dropsy. A strong tea made with the roots and sweetened with honey, has been recommended by the native doctors in India as a remedy for cholera; here, the stinging down of the seed-pods is chiefly employed as a mechanical anthelmintic.

(2150.) The *Catjang* of Amboyna is the *Cajanus flavus;* and it must be allowed that the Latinized version is much more euphonious than the original

name. In Martinique the seeds are much esteemed, and are preferred to peas. In Jamaica and the British West Indies they are chiefly used for feeding pigeons, whence their colonial name of *pigeon-peas*. This shrub is commonly planted as a fence to sugar-grounds, and the seeds are eaten and relished by the poorer inhabitants, especially the negroes. The branches, with the leaves and ripe seeds, are used as fodder to fatten hogs, and are given to horses and other cattle.

The seeds of C. bicolor are eatable, and, when young, very delicate. It is worth remarking that the seed-lobes of the *Cajani* are conferruminate, these plants being instances of Gaertner's pseudo-monocotyledons.

(2151.) *Lupinus* is said to be a diminutive of *Lupus*, and to be descriptive of the exhaustion of the soil which follows the growth of lupins. But such an explanation is physiologically erroneous, for these plants will grow in very barren places, and by the ancient Romans crops of Lupins were commonly grown and ploughed-in, as we are told by Pliny and Columella, to ameliorate the soil, a practice still continued in Tuscany and the Southern parts of France, where the ground is too bad for clover. Lupins are vigorously growing plants, and would afford the farmer abundance of wholesome green fodder for cattle; in Italy they are grown to fatten oxen. In some parts of Italy and Southern Europe, white and yellow Lupins are cultivated as human food, but the seeds are bitter; they are, however, eaten in Egypt, where they are called *Embaben*, and they are also sold in the streets of Rome, ready dressed, as grey peas used to be in Edinburgh. *Protogenes*, the Greek painter, is reported to have lived almost wholly on boiled Lupins for seven years, while engaged on his celebrated picture of Lalysus. They are, notwithstanding his prejudice that they kept his mind clear, an indigestible food: and the plant hence well merited the epithet '*tristis*,' bestowed on it by Virgil. The peduncles of *L. Termis* are eaten raw, after being peeled, by the Arabs, who also boil the seeds as food. The flowers are shewy, and many of them exceedingly handsome; hence most of the species are favorites as ornamental garden plants.

(2152.) The *Erythrinæ* or coral trees, have so been named from the vivid scarlet colour of their splendid blossoms. The seeds of *E. Corallodendron* are called Caffrarian peas, by Barrow, probably from their being eaten as such by those people. The seeds of *E. spinosissima* are said to be substituted for pepper occasionally in Java; and the bark of *E. Indica* is esteemed as a febrifuge in Cochin-china. The seeds of *E. Abyssinica* are said, by Bruce, to be called Kara or Karat in Abyssinia, and to be there used as weights for gold, whence it has been presumed we have our word *Carat*.

(2153.) *Butea frondosa* (the old *Erythrina monosperma*) and *B. superba*, both yield a red juice, which, when evaporated, becomes a hard astringent substance, known in commerce as East Indian kino. The lac insects also abound on the smaller branches and leaf-stalks of *B. frondosa* (the *pepel*), which is one of the trees from which the *lac* of commerce, improperly called *gum-lac*, is procured. *Lac* yields both an excellent scarlet dye and a valuable varnish. It occurs in commerce in different states, called stick-lac, seed-lac, shell-lac, and lac-dye. The first consists of the twigs of the tree, with the insects, and the peculiar matter with which maternal care has covered the ova. The seed-lac is the above-named peculiar substance after it has been broken off the sticks, and the colouring matter, or lac-dye, extracted by steeping in water. The shell-lac is the seed-lac sorted and melted for its purification. For the sake of the dye the lac should be collected

before the larvæ of the *Kermes Laccæ* have left the ova, but for varnish it is better after their exit. Lac varnish is much esteemed by artists, but it has long been an object to discharge the deep colour which naturally belongs to it; and premiums were offered by the Society of Arts for many years for a white-lac varnish; and the desideratum was at last supplied by my excellent friend, Mr. George Field, of Marlborough Park, who succeeded in making it transparent: a Mr. Lunen also, about the same time, made a white-lac varnish, but it was opaque like milk.

(2154.) Bengal-lac is chiefly procured from the forests of Sylhet and Burdwan, but the finest dye is obtained from that which comes from Siam and Pegu, although it is not so good for varnish as the other. Lac is also extensively used in the manufacture of hats, and in the composition of sealing-wax. Between one and two million pounds of lac are annually imported into Great Britain.

(2155.) The expressed juice of the fresh flowers of *B. frondosa*, and an infusion of the dried blossoms, will yield a water colour brighter than gamboge; and a large quantity of a durable yellow lake can be likewise prepared from them.

(2156.) *Dalbergidæ.* The normal genus of this subtype commemorates *Nicholas Dalberg*, a Swedish botanist. The expressed juice of the fresh root of *Dalbergia arborea* is said to be detergent, and is regarded in India as an excellent application to old ulcers and fistulous sores. *D.* (now called *Ecastaphyllum*) *Monetaria*, yields both from root and trunk a purplish juice, which soon concretes into a resinous mass resembling dragon's blood; but the genuine drug is the produce of an allied plant, the *Pterocarpus Draco.* Two species of *Ecastaphyllum*, are remarkable as having simple leaves, among a natural group, in which they in general are compound; and hence the present generic name.

(2157.) *Pongamia atropurpurea*, which is a very handsome tree, growing in the forests of *Burmah*, and on the shores of *Martaban*, affords a valuable building timber, much prized by the Burmese; Dr. Wallich was informed that these people also eat the young and tender leaves.

(2158.) *Pterocarpus Draco* is one of the trees which exude, when cut, a reddish sap, called dragon's blood. This resin was formerly sent in large quantities from *Carthagena* to Spain; but, from the diminished consumption of the drug, its collection has ceased, and all the dragon's blood now in the market is the produce of Calamus Draco. [§. 1091.]

(2159.) *P. Santalinus* abounds with reddish juices, which, when extracted, form likewise dragon's blood; but the wood of this tree is so deeply tinged with them that it becomes valuable as an ornamental timber, and is also used to impart its colour to several officinal preparations, as the compound tincture of lavender. It is known in commerce, as *red sander's wood.*

(2160.) *P. flavus* is the yellow sander's tree; its bark is bitter, and is used for dyeing yellow.

(2161.) *P. erinaceus* yields the astringent gum resin called Kino, which is the inspissated juices of the tree. Kino is a powerful styptic, and is much esteemed for its medicinal power in arresting inordinate discharges.

(2162.) The *American ebony*, sometimes considered a species of Pterocarpus, and at others allied to other genera, is now regarded as a distinct genus, which, from the seeds germinating before they fall from the parent tree, has been called *Brya.* But this name, although appropriate, is untenable, it being only the

plural of *Bryum*, a classic word for *Moss*, and long established as the generic designation of a large and important group of musci. [§ 777.]

As another name must be therefore found, I propose to call the genus *Wheeleria*, in order to commemorate the lengthened services of my worthy friend and preceptor, Mr. Thomas Wheeler, of St. Bartholomew's Hospital, who for upwards of forty years held the office of Professor of Botany to the Society of Apothecaries, and Demonstrator in Chelsea-garden.

(2163.) The wood of the *Wheeleria Ebenus*, or American ebony, is of a fine greenish brown colour, polishes well, and is very hard and durable. It is therefore much valued by musical instrument-makers, but the small size to which it grows renders it inapplicable to many purposes. Dr. Browne says, that the young and slender branches being very tough and flexible, are frequently used as riding switches; and that in his time they were generally kept at all the wharfs about Kingston to scourge refractory slaves.

(2164.) *Swartziaceæ.* Some doubt exists as to whether *Swartzia* and its mmediate allies should be formed into a separate type, or be considered as merely a subtype of the *Lathyraceæ*; to which, especially to the *Dalbergidæ*, they are closely connected. Their structure, however, appears to justify their typical segregation; for, although the general abortion of the petals has been anticipated by *Amorpha*, of the *Lotaceæ*, and the seed-lobes are fleshy, as in the *Lathyraceæ*, they differ essentially from both the preceding types by the stamina being hypogynous, and the corolla, when present, having also an hypogynous exsertion. This is an important deviation from the normal characters, not only of the section *Cicerinæ*, but even from the differential signs of the sub-order *Myrtosæ*, establishing indeed its affinity with the *Rhœadosæ*, yet being one of those *anomalies* which are so perplexing to such as use the natural method as an index or system of analysis; and which cease to be such when it is regarded as a synthetic scheme, and another is employed as an index.

(2165.) *Baphia* and *Zollernia*, which are associated with *Swartzia*, and its sub-generic groups, *Rittera* and *Tounatea*, to form this small type, are unarmed trees or shrubs, with alternate stipulate imparipinnate leaves, the lateral leaflets being sometimes abortive.

The inflorescence is axillary and racemose, the racemes being occasionally reduced to two or three flowers, which are monoclinious or united.

The calyx is monophyllous, that is, the sepals are so closely united that it is not until after the ovate buds have burst that the valvate æstivation of the limb is perceptible. The torus is obsolete, and hence the corolla, when present, is hypogynous; the petals vary in number, being 5, 4, 3, 1, or none. The stamina are 10 or more, uniseriate, sometimes unequal, and hypogynous. The filaments are free, or variously connected. The germen consists of a single carpel, which is many-ovuled; the style is single and terminal, and the stigma simple.

The fruit is a dry 2-valved, 1-celled, often stipulate legume. The seeds are definite, attached to the suture by a funicle that is extended into an incomplete arillus, and exalbuminous. The embryo is curved, the radicle hilose, and the cotyledons thick and accumbent.

(2166.) Hence, differentially considered, the *Swartziaceæ* are hypogynous *Lotianæ* or *Cicerinæ*, with valvate sepals, irregular or obsolete corollæ, hypogynous petals and stamens, curved embryos, and fleshy seed-lobes.

(2167.) *Baphia nitida*, a native of Sierra Leone, yields the camwood of commerce: this wood is much esteemed as a red dye stuff, and its generic name (from βαφη), indicates the use to which it is applied.

(2168.) The wood of Swartzia or *Possira tomentosa* is white, strong, and durable. In Cayenne and Guiana it yields a very useful timber. This tree grows to the height of sixty feet, and its name in Guiana is Anacoco.

(2169.) In the subgenus *Possira* the corolla is tripetalous; the vexillum and two small alæ being developed, the carina remaining abortive. In the true *Swartziæ* the corolla is monopetalous, the vexillum alone being developed; and in the *Tounateæ* the flowers are apetalous, the whole of the corolla remaining abortive. A beautiful series of gradations is here perceived, which is even rendered more easy by the corolla in *S. polyphylla* being caducous, and thus removing at a very early epoch the chief differential sign.

(2170.) The *Swartziaceæ* hence form a very interesting transitional type; for, although by the curved embryos they are associated with the Lotianæ, their subvalvate calyx, often apetalous flowers, and hypogynous stamens, connect them closely with the *Detariaceæ* and *Mimosaceæ* of the following subsection.

MIMOSIANÆ.

(2171.) *Cassia*, *Mimosa*, and *Detarium*, are the normal genera of the three types *Cassiaceæ*, *Mimosaceæ*, and *Detariaceæ*, included in this subsection. The *Mimosianæ*, as before observed, are collectively distinguished from the *Lotianæ* by their straight embryos, and from the *Connarianæ* by their hilose radicles. [§ 2018-19-21.] The genera here associated are the same as those which formed the *Lomentaceæ* of Linneus, with the exception of the *Geoffroyidæ*, which are added on account of the structure of their seeds, the straight embryo being a character of more importance than the form of the corolla. This subsection will therefore comprehend all the Leguminosæ of Jussieu not included in the preceding groups of the *Cicerinæ*, and be equivalent to the division '*Rectembriæ*' of De Candolle. [§ 2016, fig. A. C.]

(2172.) The *Mimosianæ*, collectively considered, are rectembryose *Cicerinæ*, with hilose radicles, corollaceous or apetalous flowers, and for the most part epigean cotyledons, either foliaceous or fleshy.

(2173.) Cassiaceæ. (*Cæsalpineæ*, R. Br.) *Cassia*, *Cæsalpinia*, *Geoffroya*, and their allies, associated to form this type, are trees or shrubs, rarely herbaceous plants, with round stems and branches, alternate, variously pinnate, seldom simple leaves, the midrib often furnished with peltate glands; and the stipulæ, either free or adnate to the petiole, and occasionally becoming spinescent.

The inflorescence is for the most part in racemes, and the pedicles often invested with persistent bracteæ. The flowers are shewy and united, seldom separate.

The calyx is free, in general 5-cleft, with unequal lobes, and the sepals imbricate in æstivation; the torus is expanded into a thin lamina, adnate to the bottom of the calyx. The corolla consists of five or fewer petals, and is occasionally absent. The petals are perigynous in their exsertion, alternate with the lobes of the calyx; unguiculate, free, imbricate in æstivation, unequal in size, and sometimes assuming the papilionaceous form. The stamina are definite, (10, or by abortion less,) distinct or connate, unequal in their length, and exserted with the petals. The anthers are 2-celled, the cells are opposite and dehisce, either by longitudinal chinks or terminal pores. The germen consists of a single multiovulate carpel, the style is solitary and terminal, and the stigma simple.

The fruit is either a legume or a loment, and either dry or subdrupaceous. The seeds are 1 or more, exalbuminous, and sometimes embedded in a juicy pulp; the embryo is straight, the radicle turned towards the hilum, the plumula often conspicuous. The cotyledons are large, and for the most part entire, foliaceous, and epigean: in the first subtype, the *Geoffroyidæ*, which is small, they are fleshy or oily; but in the second, the *Cæsalpinidæ*, which is large, they are foliaceous, and rarely fleshy or oily.

(2174.) Hence, differentially considered, the *Cassiaceæ* are rectembryose, hilose *Cicerinæ*, or *Mimosianæ*, with an imbricate æstivation of the sepals and petals, an irregular perigynous corolla, and unequal perigynous stamens.

(2175.) The genera associated to form the *Cassiaceæ* are distributed into two subtypes.

(2176.) Those which, like *Geoffroya*, have papilionaceous corollæ and connate stamina, are called *Geoffroyidæ*.

(2177.) And those which, like *Cæsalpinia*, have the stamens free, and the corolla not papilionaceous, are called the *Cæsalpinidæ*.

(2178.) *Geoffroyidæ*. Geoffroya and its subtypical allies are intimately related to the papilionaceous *Lotianæ*, both by the form of the corolla and the connexion of the stamens; they are hence peculiarly interesting as a transitional series, verging gradually towards the drupaceous *Rosinæ*.

(2179.) The several species of *Geoffroya* have bitter barks, which are esteemed powerful tonics; that of *G. vermifuga* is also extolled as an anthelmintic. Its wood is white and very tough; and hence it is, when procurable, valued above most others for the shafts of carriages. The seeds or kernels of the Geoffroyæ are eatable, but are rather too astringent to be agreeable; they are in general inclosed in a hard stone surrounded by a pulpy matter, so that the normal legumes of the section are absolutely superseded by drupes.

(2180.) The *Cabbage tree* was formerly arranged as a species of *Geoffroya*, but it is now considered generically distinct, and called *Andira inermis*. The bark of this tree, (Med. Bot. 144,) when powdered, resembles jalap, both in its appearance and properties. Its action is, however, more violent; and hence an overdose has sometimes produced serious results, as violent vomiting, hypercatharsis, delirium, and fever. In the West Indies and America it is esteemed as a valuable anthelmintic; the seeds possess the like powers with the bark, and a single one has proved effectual in dislodging the tape-worm. The bark and seeds of *A. racemosa* and *retusa* have also been employed for similar purposes.

(2181.) *Arachis hypogæa* is the curious *earth-pea*, or *underground-nut*, of

Africa, the West Indies, and the continent of America. In this plant the uppermost flowers are sterile, those which grow near the ground, on the procumbent or trailing branches, alone bearing fruit. After the blossoms have fallen the peduncles elongate, and the pods, as they enlarge, are buried beneath the surface of the soil. The seeds are thus ripened in a situation the most fit for their future growth; but the final cause of this curious economy, which is observable in *Trifolium subterraneum*, and a few other plants, as well as in *Arachis*, and its ally *Voandzeia*, physiology has not yet explained.

(2182.) In *Carolina*, and in all the European settlements, the underground-nut is cultivated as food. The seeds are eaten either raw or roasted, and are often made into a kind of chocolate. The seed-lobes abound in oil, which is expressed for burning or for table use, but it is inferior to olive oil in flavour. In the eastern countries these nuts, or seeds, are substituted for almonds; and the marc, when the oil has been expressed, is made into cakes by the negroes in the West. The imported fruit is commonly to be met with in the English markets; but in the neighbourhood of Paris the plant is cultivated as a delicate legume.

(2183.) The *Voandzou*, or *underground-pea*, of Madagascar, is the *Voandzeia* or *Cryptolobus* of botanists. Like Arachis, it buries its pods beneath the soil, and in many tropical countries the seeds are boiled in an unripe state, and eaten as peas.

(2184.) The *Tonquin* or *Tonka bean*, is the fruit of *Dipterix* (or *Coumarouma*) odorata. In Guiana, where the plant grows indigenously, it is called Coumarou ; and hence its subgeneric name. The aroma of the seeds is owing to a volatile oil that contains a peculiar proximate principle, once mistaken for Benzoic acid, but since recognized as distinct, and called Coumarin. According to M.M. Boullay and Boutron-Challard, it is neither acid nor alkaline, and is a peculiar principle, nearly allied to the essential oils. The Tonquin beans are here chiefly employed to scent snuff, but in the West Indies and America they are put by the Creoles into chests of clothes, to drive away insects. The wood of the Coumarouma is sometimes used medicinally for the same purposes as guaiacum.

(2185.) *CÆSALPINIDÆ*. (*Cassieæ*, D.C.) About sixty known genera belong to this subtype, of which *Cæsalpinia*, *Cassia*, *Hæmatoxylon*, *Ceratonia*, *Tamarindus*, *Copaifera*, *Cathartocarpus*, *Hymenæa*, and *Cercis*, are the most important.

(2186.) *Cæsalpinia* is a genus commemorative of Andreas Cæsalpinus, the reputed father of systematic botany. It is divided into four subgenera, *Nugaria*, *Brasiletta*, *Sappania*, and *Libidibia*, all the species included in which, especially in the second and third sections, yield valuable dyes, and are known in commerce as *Brazil woods*. The colour of *C. Sappan* is less durable than that of *C. Brasiliensis*, the true *Braziletto; C. crista* and *echinata* are said to be richer in colouring matter than the other species, and the latter is the most sought after. The timber of *C. Braziliensis* is elastic and tough, takes a fine polish, is of a beautiful orange and red colour, and very durable. *C. coriaria*, (the Libidibi of Curaçoa), contains a great deal of astringent matter in its fruit, and hence the pods are used both by the Spaniards and natives to tan leather.

(2187.) *Moringa pterygosperma* is the *Muringo* of Malabar. All parts of the plant are hot, and its juices acrid, especially the seeds and roots. The former

have been employed medicinally in fever, and also as rubefacients; and the latter, from its pungent flavour, is used as a condiment instead of horseradish.

(2188.) The ben-nuts of the Levant are the seeds of *M. aptera*. The cotyledons are oily, and the ben-oil, so long famed for its use in perfumery, and its employment by clock-makers, is expressed from these seeds. The oil is scentless and tasteless, does not become rancid, and separates, on standing, into two parts; one of which, by resisting extremes of cold without congelation, is valuable in horology, the other, or both, combined, form the basis which receives the varied scents of the numerous fragrant oils so much demanded in the East.

(2189.) *Gleditschia triacanthos* is the honey-locust tree of the North Americans, and the 3-thorned acacia of our gardeners. Its seeds are covered with a sweet pulp, from which, when infused and fermented, an intoxicating liquor is occasionally made.

(2190.) *Guilandina Bonduc*, and *Bonducella*, are the *Bonduc* or necklace trees of the Arabs. In Egypt the seeds are strung as beads by the women, and used by the boys instead of marbles.

Both the bark and seeds are bitter, and are employed in decoction as astringent lotions and discutient poultices, as well as being administered internally in fevers.

(2191.) *Coulteria tinctoria* and *Poinciana pulcherrima*, plants nearly allied to the Cæsalpiniæ, have highly coloured woods, which are used in dyeing like Brazil wood. The leaves of the latter are purgative, and are called *senna* in the West Indies, being often substituted for the genuine drug. It also enjoys, among the negresses, the reputation of being a most energetic emmenagogue, and is resorted to by them for criminal purposes.

(2192.) The Campeachy or Logwood of the dyer, is furnished by the *Hæmatoxylon Campeachianum*, its generic name referring to the blood-red colour of the timber, and the specific one to the place whence it was first brought. The colouring power of logwood is owing to a peculiar principle, called by chemists hæmatine. Logwood is astringent, and both in decoction and extract has a sweetish taste, which makes it preferable to many other vegetable astringents as a medicine. The chief use of logwood is, however, as a dye-stuff; and on an average between 14 and 15,000 tons are annually imported into this country for that purpose, more than half of which is brought from the British West Indies, and the rest from Mexico and the United States. We learn from Dr. Bancroft, that logwood was first imported about the beginning of the reign of Queen Elizabeth; "but the various and curious colours dyed from it proved so fugacious, that a general outcry against it was soon raised, and an act of Parliament was passed in the 23d year of her reign, which prohibited its use as a dye, under severe penalties, and not only authorised but directed the burning of it, in whatever hands it might be found within this realm;" and it continued subject to this prohibition for nearly 100 years, for it was not until the 13th and 14th of Charles II. that the above penal statute was repealed.

(2193.) *Parkinsonia aculeata* is the *Jerusalem thorn* of Jamaica; like many of its associates, it is bitter, and is used by the Mulattos as a febrifuge.

(2194.) The *Ceratonia* of Theophrastus was a plant, the fruit of which bore some fancied resemblance to a horn, and hence it not improbably was the Carob or Saint John's bread, often brought to this country from Spain, under the name

of *Algaroba* bean; *Al-garoba*, like our carob, being only a slight variation of the Arabic *Kharroub*, with the article prefixed.

(2195.) The *Ceratonia Siliqua* is a native of the Levant, and of the southern parts of Europe; it is much cultivated in Spain for the sake of the pods, which are esteemed as food. And some persons believe its tender shoots and fruit to have been the sustenance of John the Baptist in the Wilderness, whence the tree has been called *St. John's bread.* Professor Martin stigmatises such an opinion as the offspring of ignorance; but, on the other hand, it must be observed, that the word which we translate *Locusts* means also, in the original, the *buds* or *pods* of various plants; and, although locusts are a common food in some oriental countries, so that whole tribes of Ethiopians were named, from the custom of eating them, *Acridophagi*, still they were never eaten without some previous preparation, such as roasting or drying them in the sun, salting or smoking them; occupations which, as Dr. Harris remarks, do not seem to be such as would have engaged the time and attention of the Baptist.

During the Peninsular war, the Algaroba beans often formed the chief food of the British cavalry horses, especially in the years 1811 and 1812. In Barbary, mules, asses, and other cattle, are fed on them, and most beasts prefer them to oats. The sweet pulp which invests the seeds, often called honey, is made into a pleasant beverage with water, that is publicly sold in the streets of Cairo. conserves are also made from the fruit, and it has been medicinally employed as an agreeable demulcent in pectoral complaints. By the ancients the pods were called *Siliquæ dulces*, and hence the present specific name of the *Ceratonia*. The bark and leaves are astringent, and are used in the process of tanning.

(2196.) The *Castanospermum Australe*, the chesnut-bean, or Morton Bay chesnut, bears several seeds, usually four, in each pod, which are as large as ordinary chesnuts, and when roasted have very much the flavour of the true *Castaneæ*. They are eaten by the New Hollanders as a common food, and Europeans have occasionally lived on them solely for two or three days together.

(2197.) *Amherstia nobilis*, the *Thoka* of the Burmese, is one of the most splendid vegetables known. When in full leaf and blossom, with its large pendulous racemes of rich scarlet flowers hanging in profusion from every part of its noble stem, it is indeed superb. It was discovered growing in the garden of a decayed *kioun* or religious establishment in Burmah, about twenty-seven miles from Martaban. Handfuls of the flowers of this tree are presented by the devout as offerings, in the caves, before the images of Buddha.

(2198.) The *Tamarind* or *Tetul* of Hindustan, is a native of Egypt and Arabia, as well as of the East Indies. The date, called *Tamar* by the Arabs, being their most common and valuable fruit; other important fruits have been called dates or *tamars* likewise, with some distinctive epithet adjoined. Hence the one in question received the name of *Tamar-hendi*, the date of India, whence our word *Tamarind*. Ignorance or neglect of this circumstance led botanists to add *Indica* as the specific name, to a generic one in which the habitat of the plant already was included.

Tamar-indus Indica, the Indian date of India, is therefore, as Dr. Francis Hamilton has observed, in his Commentary on the Hortus Malabaricus, "a vile pleonasm," and the sooner it, and some others like it, become obsolete in the language of botany, the better. Hence, as there are two species of tamarind, the

one growing in the East Indies and the other in the West, and as the West Indian species is called *T. occidentalis*, *T. orientalis* would be an appropriate distinctive name for the East Indian one.

(2199.) The wood of the tamarind tree is heavy, firm, and hard, and is a useful building timber; but it is for its fruit that the tree is most known and valued. The pods of the tamarind consist, like other pericarps, of three layers or coats, such as are very evident in the plum and the peach. The outer one, called the epi- or rather the exo-carp, the inner one next the seed (or lining the plum-stone), called the endo-carp, and an intermediate one (which is fleshy in the peach and plum), termed the meso-carp. In the tamarind the endo-carp is very thin, and often not easily distinguishable, and the pulpy matter for which the fruit is prized is the meso-carp. This pulp contains sugar, with a large proportion of acid matter; both citric and tartaric acids, as well as malic acid and supertartrate of potash, being found on analysis: and hence the refreshing properties of the fruit and its medicinal use in fevers. The oriental tamarinds are more pulpy than the occidental ones; they are also darker in colour; and, being preserved without sugar, are more acid, and better adapted for medicinal purposes, than the West Indian fruit, which is preserved by the addition of a considerable quantity of sugar. The latter, however, form the most agreeable dessert.

(2200.) Tamarinds are used to increase the cathartic effects of manna, cassia pulp, and other sweet purgatives, but they lessen the action of resinous cathartics, and are an improper addition to the salts of potash.

In India a kind of sherbet is made by the natives by steeping tamarind pulp in water; and in times of scarcity the tamarind stones, divested of the skin, which is very astringent, are roasted and eaten as beans by the poorer people. A decoction of the seed-coats is prescribed by the Tamul doctors in dysentery, and the leaves are also employed as repellent poultices, and in decoction as collyria. In the West Indies a similar decoction is given to children as a vermifuge.

(2201.) The genus *Cassia*, although lessened by the separation of the *Cathartocarpi*, *Delariæ*, and *Chamæfistulæ*, still contains a long list of species, amounting to upwards of 200, and which it is therefore convenient to arrange in several subgeneric groups. Those which appear to be the best characterized are six in number, viz. *Herpetica*, *Senna*, *Chamæsenna*, *Baseophyllum*, *Absus*, and *Chamæcrista*. A cathartic power is the most remarkable general feature of these plants, and it pervades the entire group, being, however, more or less predominant in certain species, especially in those contained in the subgenera *Senna* and *Chamæ-senna*. Chemical analysis has shewn that the active properties of the sennas depend upon a peculiar proximate principle called cathartine.

(2202.) *Herpetica alata* has so been named from its real or supposed influence in the cure of cutaneous diseases, especially those of the herpetic kind; either poultices or lotions made by boiling the leaves or flowers are, it is said, very effectual in the cure of ringworm.

(2203.) The senna of commerce is often a strange mixture of various leaves, not only of different species of cassia, but even adulterated largely with those of other genera, such as the *Cynanchum Argel*, which is introduced by the foreign traders, and the *Colutea* or bladder-senna, which is added here. Indeed, the practice has been carried on to such an extent, as to persuade Nectoux, that the real cathartic drug is *Argel*, which, he says, the Alexandrian merchants *adulterate*

with *senna*, in order to meet the demands of Europe, which always exceed by a third or more the annual crops. Rouillon, however, states that the traders at Cairo mix only two parts of *Argel* leaves with three of *C. obovata* and five of *C. lanceolata*.

(2204.) *C. lanceolata* (acutifolia, De L. which, however, it is probable, is specifically distinct), is the Alexandrian or British officinal senna; *C. obovata* is the Italian officinal senna; and another species, or perhaps a variety of the first-named, is imported and occasionally used here under the name of East Indian senna. In America C. or Chamæsenna Marylandica is the officinal species.

(2205.) The purgative qualities of senna were known to the Arabian physicians Serapion and Mesue, who flourished about the beginning of the ninth century, and used it as a medicine. Actuarius, a Greek physician, who lived in the thirteenth century, also notices it; but he, like Mesue, employed the pods, not the leaves. It was, however, most probably used medicinally in much earlier times, for, according to Olaus Celsus, the Greek word *Cassia* (*κασσια*), which is found in Dioscorides, is derived from the Hebrew *Ketzioth*, rendered in the Septuagint by *κασσιαν*; and this has been Latinized by Cassia. Senna is but a slight variation of *sæna* or *sænna*, the Arabic name of the plant; and this, like cassia, is said to own a Hebrew origin; and the passage in which it occurs, Isaiah xxxvi. 12, Mr. Rootsey says, he should translate '*Sedes liquidas*:' thus shewing that it was celebrated in the early ages for the same uses to which it is now applied, and for which powers it has in modern times become proverbial. Thus Shakspeare says, in *Macbeth*,

> "What rhubarb, senna, or what purgative drug,
> Would scour these English hence."

(2206.) Rheede says that the bruised leaves of *Chamæsenna Tagera* are used in India to relieve the pain of insect stings, especially bees, and also as poultices to painful ulcers.

The roots of *C. venenifera*, which is the Piami of Guiana, are there used by the natives to intoxicate fish; and *C. occidentalis*, the stinking weed of Jamaica, is one of the plants the tops of which are commonly employed in resolutive baths and fomentations.

(2207.) *Cassia Absus* is esteemed in Egypt as a remedy in ophthalmia. The seeds are steeped for sometime in water, then dried and pulverised, and the powder introduced beneath the eyelids.

(2208.) The leaves of *C. Chamæcrista* are purgative, and a good substitute for genuine senna.

(2209.) The pods of *Chamæfistula* are long and pulpy, and, like those of the cathartocarpi, are purgative.

(2210.) Cassia pulp, which has been long famed as a mild and pleasant aperient, is the pulpy part of the pod of a genus allied to *Cassia*, which, from the laxative properties of the fruit, has been called *Cathartocarpus*, [§ 2016, A.] All the species of this genus afford an aperient pulp, but those chiefly valued are *C. Fistula* and *Fistuloides*. It has been asserted that these plants impart their cathartic properties to the flesh of animals that feed upon their leaves, but this requires confirmation.

(2211.) *Copaifera* is a genus, various species of which yield the well known

balsam of Copaiba; Capivi and Copaiva being only variations of its Brazilian name: in Venezulea it is called *Tacamahaca*. The chief supplies are drawn from the *C. Langsdorfii* and the *C. Jacquiniana* or *officinalis*, the former of which is a native of Brazil, and the latter of the West Indies. The best balsam is said to be that which comes from Brazil; and it is much valued for its power of moderating and restraining morbid secretions of the mucous membranes, and lessening their irritability. During the war, when its price was high, there were great temptations to mix other resinous substances with it, and a considerable part of that sold in London was entirely fictitious. Dr. Paris, in proof of this, mentions "a curious trial which took place sometime since, between the owner of certain premises that were burnt down and the governors of the Sun Fire Office, in consequence of the latter refusing to indemnify the proprietor for his loss, because the fire had been occasioned by the *making of balsam of Copaiba*."

(2212.) *Intsia*, *Eperua*, *Parivoa*, *Anthonota*, and *Vouapa*, five allied genera, are chiefly interesting for the reduction of their petals, the corolla in all being truly monopetalous, thus establishing a connexion with Amorpha and the Dalbergidæ on the one hand, and the apetalous *Detariaceæ* on the other. Even *Copaifera* itself is described by most botanists to have apetalous flowers, the perianth being single; and hence, although corollaceous, in truth a calyx; in *Outea* likewise, notwithstanding the corolla is pentapetalous, one petal only is well developed, the other 4 being minute, and almost abortive.

(2213.) The leaves of *Hymenæa* and *Bauhinia* being twin-lobed or united in pairs, has led to the dedication of the latter genus to John and Caspar Bauhin, two distinguished botanists, united not only by blood but by science, and of the former to the god of marriage.

(2214.) The several species of *Hymenæa*, especially *H. Courbaril*, *Martiana*, *stilbocarpa*, and *verrucosa*, yield a peculiar aromatic resin, known in commerce as *Gum animi* (or *Hymeny?*). This substance, which is transparent and of a fine yellowish red or white hue, is found exuded in large lumps between the principal roots of the trees. The French pharmacologists assert that the amber-like resin of *H. Courbaril* is tasteless, and thus differs from the true Gum animi, which they affirm to be the produce of H. Martiana. Gum animi has been recommended as an antispasmodic, and, when burned by way of fumigation in the chambers of persons labouring under paroxysms of asthma or suffocative catarrhs, it is said to relieve the distressing dyspnœa, as well as to be grateful from its fragrance. Its chief consumption is, however, in the manufacture of varnish, and, when dissolved in highly rectified spirit of wine, it is said to be superior even to the *lac* of China.

(2215.) The pods of *H. Courbaril* contain a soft filamentose substance as sweet as honey, and having an aromatic flavour something resembling gingerbread. The Indians are extremely fond of this fruit, and the monkies as well as the children devour it with avidity; it is laxative when fresh, but, by keeping, the cathartic property is lessened, or entirely removed. In the Antilles an intoxicating liquor is prepared, by boiling the pods in water and leaving the decoction to ferment. The heart-wood of this tree is very hard and tough, and is hence much valued for wheel-work, particularly for cogs in sugar-mills. It will take a fine polish, and is so heavy that a cubic foot weighs about 100 lbs. It is called 'mountain ebony.'

(2216.) Several species of *Bauhinia* are said to be carminative and astringent,

and a decoction of the root of *B. tomentosa* is said by the Indian practitioners to be serviceable in dysentery. The Moluccese have a notion that the leaves of *B. scandens*, put within or held before the lips, facilitate articulation, and hence they call the plant *Daun lolab mubul*, which means "to open the mouth."

In the *Bauhinæ*, as well as in *Jonesia*, there is a remarkable cohesion between the base of the ovary and the calyx.

(2217.) *Cercis Siliquastrum* is called the Judas tree, in deference to a popular but unfounded belief that it was, as Gerarde writes, [to correct previous errors,] "the tree whereon Judas did hang himself, and not upon the elder-tree, as it is said." The leaves of this plant have an agreeable acidity, and are hence frequently eaten as salads on the Continent; and those of *C. Canadensis* are commonly pickled by the French Canadians. The wood of both species is very beautifully veined with black, and the buds and young branches of the latter will dye wool of a fine nankeen colour.

(2218.) The *Codaria* are the velvet tamarinds of Sierra Leone and Guinea, where their pulpy pods, replete with sweetish meal, are eaten by the natives.

(2219.) *Aloexylon Agallochum* yields the aloes-wood of commerce, or at least, the greatest proportion of that valuable perfume. In Eastern countries it is held in high estimation as a cordial medicine, and is used by the Chinese and heathen Moors as incense in their sacrifices: it is employed also as a setting for the most precious gems. It was once deemed of greater value than gold, and various fables concerning the tree which produced it have prevailed. One of these feigned that it grew in Paradise, and that it was conveyed thence by the rivers when they overflowed their banks; and other as veritable legends tell that it flourishes only on inaccessible ground, where it is guarded by wild beasts. Like the *Calambac* or eagle *Agallochum* (Aquilaria, § 1588), the wood of this tree, when sound, is white and scentless; and its fragrance is owing to some morbid action which changes the secretions, that are naturally inodorous, into the highly aromatic oils and resins upon which the value of the costly wood depends.

(2220.) Mimosaceæ. *Acacia, Mimosa*, and their immediate allies, associated to form this type, are trees or shrubs, rarely herbaceous plants, and often armed with thorns or prickles. Their leaves are alternate, abruptly pinnate, often bi- or tri- pinnate, with opposite pinnæ and pinnulæ, seldom imparipinnate, and sometimes irritable to the touch. The stipules are free, and frequently spinescent.

The inflorescence is in spikes or conglobate tufts, and the flowers, which are yellow, white, or reddish, regular, united, or by abortion polygamous.

The calyx is free, 4-5-sepaled, the lobes equal, sometimes discrete, but usually connate; and generally valvate in æstivation. The corolla is 4-5-petaled, the petals equal, discrete, (or occasionally connate at the base,) deciduous, subperigynous, or hypogynous in their exsertion, and valvate in æstivation. The stamina are exserted with the petals, indefinite, (or, when definite, equal to the petals in number, or some multiple thereof,) and often monadelphous at the base. The anthers are roundish, 2-celled, with opposite locules, and a longitudinal dehiscence. The germen consists of a single carpel, which is 1-celled and many-ovuled. The style is single and terminal, and the stigma simple.

The fruit is either a dry 1-celled legume, or a multilocular loment. The seeds are few or many, smooth, with a marginal hilum, and attached horizontally to the suture by enlarged and generally twisted funicles. The albumen is absent, the embryo straight, the radicle small and turned towards the hilum, the plumula in-

conspicuous, and the cotyledons large, entire, and foliaceous, (in all except *Entada* and some species of *Inga*,) and for the most part epigean during germination.

(2221.) Hence, differentially considered, the *Mimosaceæ* are rectembryose bilose *Cicerinæ* or *Mimosianæ*, with valvate sepals and regular hypopetalous corollæ, and hypogynous or subperigynous stamens.

(2222.) *Entada* is a generic term, adopted on account of its being the Malabaric name of one of the species. *E. Pursetha* is reputed in Java to be possessed of emetic properties; but these plants are chiefly remarkable for the immense size of the pods; those of *E. gigalobum* are six or eight feet long, and, being gently curved, resemble gigantic scymitars. Their seeds are also enormous, being nearly round, and about six inches in circumference. Two deviations are also observed among them from the normal characters of the type, viz.; 1st, their cotyledons are fleshy and hypogean, remain within the spermoderm, and are unchanged during germination; and, 2dly, the flowers of E. polystachya are sometimes apetalous.

(2223.) The extraordinary irritability and curious motions of the sensitive plants, mimicking as it were the actions of animal life, have given to them the appropriate name *Mimosa*. Of these, the *M. sensitiva* and *pudica*, the sensitive and the humble plants of our conservatories, are, especially the latter, the most familiar examples. The movements of the leaves and leaflets of these vegetables upon the slighest touch have always excited attention, and many speculations have been adventured to account for the phenomenon. Most persons have attributed the irritability to the presence of a rudimentary nervous system in plants; and hence by some botanists, as by Bartling, they have been placed at the summit of the vegetable kingdom, as the nearest approach to animal vitality. But such an arrangement is manifestly erroneous, for it is between the simplest grades of each kingdom that the similitude between animals and plants is the greatest, and their respective differences the least, [§ 151, 181, &c.] And as to the possession of a nervous system by the sensitive plants, there is no sufficient proof of the assertion.

The mechanism, however, by which their motions are performed, is extremely curious; and an account of it may be seen in Brande's "Journal of Science," in Mayo's "Outlines of Physiology," in Dutrochet's "Memoire sur la Motilité des Vegetaux," and in a paper, by Mr. Lindsey, read before the Royal Society, but not published.

(2224.) *M. abstergens* is esteemed in India as an expectorant. The leaves are slightly acid and laxative; the natives use them in decoction to cleanse the hair, and an aperient confection is made with the fruit.

(2225.) *M. asperata* is both cathartic and emetic, and is used medicinally by the negroes in St. Domingo; and the roots of *M. sensitiva* and *pudica* are said to be possessed of similar properties. A beautiful kind of rose-wood, the *Jacaranda* of commerce, is said by Prince Maximilian to be the timber of a Brazilian Mimosa.

Augustus de St. Hilaire found in Brazil a species of Mimosa, with 5 aggregate carpels. This is a fact of morphological importance, as it confirms the theoretical doctrine that the legumes are, in the Cicerinæ, solitary by abortion, their normal disposition being in whorls of 5. The occasional development of two ovaria in *Gleditschia* and *Wisteria Sinensis*, and their constant evolution in *Diphaca* and *Cæsalpinia digyna*, once considered anomalies, corroborate this view.

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(2226.) *Inga* is a genus formed by the segregation of upwards of 130 species of *Mimosa*. They are chiefly handsome trees and shrubs, and several are useful as food and in domestic economy. *Inga vera, sapida, dulcis, feculifera,* and *fagifolia,* contain a sweet pulpy matter in their pods, which is also agreeably acid, and is esteemed as food. The pulp of *I. laurina* is laxative. The bark of *I. cochliocarpos* is astringent; it is recommended as a dressing to foul ulcers, and also for tanning leather. The pulpy fruit of *I. cyclocarpa* is used to bleach linen, and both the bark and seeds of *I. saponaria* are employed as substitutes for soap in washing. The pods of *I. Marthæ* exude a gummy matter, which is collected for use. The wood of *I. Caven* is yellow, and esteemed in carpentry; its pods contain an astringent mucilage, and enter in some places into the composition of ink. *I. salutaris* enjoys in New Grenada a high reputation as an astringent tonic, its bark in decoction being the part employed; and the astringent bark of *I. Unguis Cati* is also used in America in lotions and fomentations, and its seeds, called in Jamaica black-beans, are eaten there by goats, and sometimes by the negroes. They are occasionally brought to England, and strung as beads.

(2227.) The *Parkiæ,* which commemorate the enterprising traveller whose name they bear, are natives of the Northern and Western parts of Africa; and one species, of the forest of Sylhet, in the East Indies.

P. Africana is the Doura of Soudan: its seeds are there roasted as we roast coffee; and when they are bruised and steeped in water, and allowed to ferment, a pleasant drink is produced. When the marc of the powdered seeds begins to putrefy, it is washed, again pounded, and made into cakes resembling chocolate. This substance forms an excellent sauce for all kinds of food; and the sweet pulpy matter which surrounds the seeds is either eaten raw, or made into a kind of sweetmeat, or, when steeped in water, an agreeable beverage is formed.

P. uniglobosa is the *Nitta* of Mungo Park, and its fruit is eaten by the Africans like that of the preceding species.

(2228.) The fruit of *Desmanthus* (olim Mimosa) *cinereus* is eatable; its flavour is slightly acid and refreshing. Ainslie states that the pods are pounded, and applied in India to the eyes in cases of ophthalmia.

(2229.) *Adenanthera Pavonina,* the *Mandsiadi* of Malabar and Ceylon, is one of the largest trees of Hindustan, growing to the height of upwards of 100 feet, and its timber is much valued on account of its solidity. The seeds are esculent, but, besides being serviceable, as food for the common people, they are, from the equality of their weight, in general use with jewellers and goldsmiths, to weigh their valuable wares; each seed is equal to four of our grains. The native Indians employ the powdered leaves in some of their religious ceremonies, and in decoction as a remedy for chronic rheumatism. They also make a cement by pounding the seeds with borax.

(2230.) Several species of *Prosopis,* from the resemblance of their pods to those of the carob, are called Spanish algarobas, and the sweet pulp of *P. spicigera, horrida, dulcis,* &c. is eaten in the same manner as that of the St. John's bread, while the pericarp consists almost wholly of tannin, and is hence most valuable in the manufacture of leather. The fruit of *P. dubia* is said to be saponaceous, and to be used like the *Inga saponaria* in washing.

(2231.) *Acacia* is a very extensive genus, including upwards of 320 known

species, most of which are handsome trees or shrubs. Some of them are physiologically interesting, not only for the conversion of their stipules into spinacules, but, as in the New Holland Acaciæ, for the abortion of the true leaves, and the expansion of the petioles into leaf-like organs, called *Phyllodia* [§ 2016, c]; the normal compound foliage being present only in the seedling plants. The phyllodia in *A. ornithophora* are curious in their shape, having a strong resemblance in their outline to the figure of a bird; and hence the specific name. *A. pilosa* is remarkable for having stipules as well as thornlets, the spinacules in general being the metamorphosed stipules: and *A. cornigera*, for its thorny stipules being extremely large, and so very similar to the horns of an ox, that the plant in common parlance has received a fearful name.

The bushy *Acaciæ* form excellent hedges, and in their wild state impenetrable thickets, such for example as *A. detinens*, which so often arrests the traveller by its thorns, and *A. latronum*, the groves of which are not only secure retreats to the smaller animals, but become as it were cities of refuge to rogues and runaways, for pursuit is vain where it spreads its protecting arms; and hence indeed it has been specifically called the "Rogue's Acacia."

(2232.) Other Acaciæ, on the contrary, are of economical importance, such especially as the gum-bearing species, and those which abound in astringent principles fit for tanning.

(2233.) Gum arabic may be procured from upwards of forty species of Acacia, and a gum scarcely differing from it is yielded by various other plants, but in different degrees of purity, and in very variable proportions. The chief of the gum arabic of commerce is derived from *A. vera, or Nilotica, Arabica,* and *gummifera:* the supplies afforded by *A. decurrens, floribunda, Lebbek, Sassa,* and others, are much more scanty. Gum Senegal is a variety collected from the Acacia Senegal; by some persons it is preferred, and by others considered inferior to gum arabic: it is usually in larger masses, of a darker colour and more clammy and tenacious than gum arabic, but both are frequently mixed together.

(2234.) The gum harvest in Arabia usually begins about the middle or end of November, that is, after the close of the rainy season, which commences in July. The gum exudes spontaneously from the trunk and principal branches of the trees, and those which are in a sickly state afford it in the greatest abundance. The Moors at this time encamp on the borders of the Acacia forests, and remain there during the harvest, which lasts about five weeks. The gum is packed in very large leathern sacks, and brought on camels or bullocks to Suez, and other ports on the Red Sea, which are the principal marts. Gum is extensively used in the arts, particularly in calico-printing, and large quantities are imported into this country for that purpose. Between 8 and 9,000 cwt. is the average annual importation, and of this nearly one-half comes from the East Indies, and the rest is brought either directly or indirectly from the Levant. Its cost, however, has compelled ingenious men to convert starch into a substance closely resembling it, and which is called "British gum."

(2235.) Gum is a highly nutritious substance, and in Senegal and Arabia and other countries, where it naturally abounds, it forms an important article of diet, either alone, or mixed with rice and other substances. In Guzzerat, especially in the wastes where the Balbul tree (*A. Arabica*) is common, the poorer inhabitants eat gum as their common food. During the whole of the time of the gum-harvest,

of the journey, and of the fair, the Moors of the Desert live almost entirely upon it, and experience has shewn that six ounces are sufficient to support an adult for twenty-four hours. Haselquist informs us that a caravan, when their provisions were exhausted in the Desert, preserved themselves from famine by eating the gum arabic, which formed part of the merchandise they were transporting.

(2236.) The bark of the gum-bearing *Acacias*, as well as that of various other species, such as *A. leucocephala*, *ferruginea*, *peregrina*, and *tenuifolia*, are very astringent, contain much tannin, and promise to become of great commercial importance. In 1824 several tons of acacia bark were brought from New South Wales for the use of the tanners of England; and in Nubia the pods of *A. Nilotica* are employed in the manufacture of leather. *A. Catechu* is, however, the most astringent and the most rich in tannin of the whole. It yields that valuable medicinal agent called *terra Japonica*, the source of which was so long unknown. Catechu is procured from the brown heart-wood, and not from the bark of this tree, and the process of extraction consists in cutting the duramen into fragments and boiling the chips in water, which is subsequently strained and evaporated to a proper consistence.

(2237.) *Catechu* is a valuable astringent, and is used medicinally to restrain morbid discharges. It is also very rich in tannin, a circumstance first noticed by Sir Joseph Banks, and subsequent inquiries have estimated the proportion to be ten times greater than in oak-bark. In India, this extract, there called *cutt*, (whence *cate*, *kaath*, *caitchu*, *cachou*, *cadtchu*, a few of its various names, have been derived,) is much used by the natives in dyeing and painting chintz and other cloths, and mixed with oil they daub with it the beams and walls of their houses to preserve them from decay, and to defend them from the attacks of the destructive white ants, to whom it is very offensive; hence it is also sometimes mixed with the plaster which covers the walls.

The powdered bark of *A. ferruginea* is used in India to corroborate spongy gums, but it does not seem to be superior to catechu, which forms an excellent tooth-powder.

(2238.) The wood of the arboreous acacias is strong, tough, and durable, and, from the crookedness of the boughs, they make excellent knees and elbows for ship-building. *A. Doratoxylon* is the spear-wood of certain tribes in the interior of New Holland. The timber of *A. Sundra*, a native of the Coromandel coast, is hard and of a fine chocolate colour; and it probably would yield a kind of catechu. The wood of *A. Cavenia* is esteemed at Valparaiso for making excellent charcoal, and the bark of *A. Arabica* is used in decoction as a substitute for soap, and as a dye-stuff. Humboldt tells us that the Indians on the Orinoco employ the powdered seeds of *A. Niopo* as tobacco, and smoke them as a luxury. Forskal says that, in Arabia, the leaves of *A. Orfota* are put into the camel's milk to prevent it coagulating and turning sour, and that it may thus be preserved fresh and sweet for many days. The bark of *A. pennata* affords a kind of tow, from which ropes might be made, and which is used in Cochin-china as oakum to fill up cracks in boats and houses. The pods of *Acacia esculenta*, a native of Mexico, are eatable, and the leaves of *A. Giraffæ* are said to be the favorite food of the camelopard.

(2239.) *Erythrophleum Guineense* is the *Gregree* or Ordeal-tree of Sierra Leone and Guinea. The generic name refers to the red juice with which the stem and branches abound. This tree, like our trial by battle, is appealed to by

the ignorant natives to declare God's judgment, and the effects which follow the ordeal are considered as proofs of the guilt or innocence of accused persons.

The juice, or a decoction of the wood, is given to the accused to drink, and if vomiting occurs without being followed by death, the parties are declared innocent; but if they die, they are condemned as guilty.

The irritability of the stomach or the will of the judge, in reality, is thus the gauge of guilt; for, if the fault be slight, or the judge inclined to favour the prisoner, a portion of the bark is given him to chew, which is invariably rejected by the stomach, and the accused escapes; but if the charge be grave, or the judge unfavourable, the decoction of the wood is given, and then the accused has little chance.

(2240.) Detariaceæ. The two genera, *Detarium* and *Cordyla*, each containing but one known species, are all the plants included in this small type. They are separated from the other *Mimosianæ*, on account of their drupaceous fruit, by which they form the transition from this section to the Amygdalaceous *Rosinæ;* a connexion which has however been anticipated by several of the Cassiaceæ, especially by *Geoffroya spinosa.*

(2241.) The *Detariaceæ* are African trees, with imparipinnate leaves and axillary inflorescence; the flowers are united and disposed in racemes, the calyx 4-lobed, globose before expansion, and valvate in æstivation. The corolla is abortive, the stamens [10-35] perigynous, and nearly free, ovary simple, style single, and stigma undivided.

The fruit is drupaceous, 1-celled, and 1-6 seeded. The seeds are exalbuminous, the embryo straight, the radicle next the hilum, and the cotyledons fleshy.

(2242.) Hence, differentially considered, the *Detariaceæ* are rectembryose, hilose *Cicerinæ*, or *Lotianæ*, with apetalous flowers, valvate sepals, perigynous stamens, and drupaceous fruit.

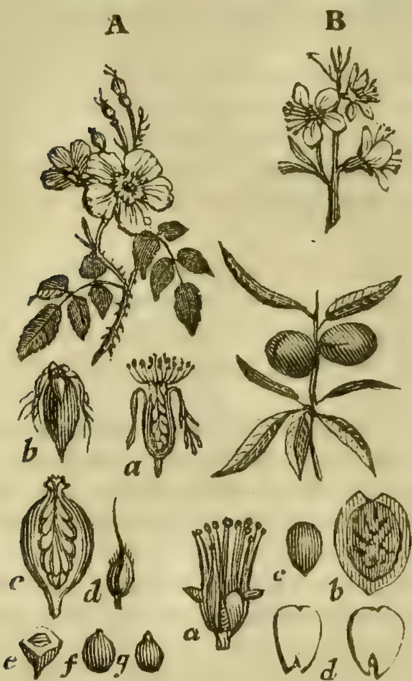
(2243.) The fruit of *Cordyla* is eatable, but very little is known of the properties of these plants besides their freedom from deleterious principles; and they have not hitherto been applied to any useful purpose.

ROSINÆ.

(2244.) The Plum, the Apple, the Meadow-sweet, the Rose, and the Burnet, are the typical genera of the five natural families, *Prunaceæ*, *Pomaceæ*, *Spiræaceæ*, *Rosaceæ*, and *Sanguisorbaceæ*, included in the section Rosinæ. The plants here associated are very nearly allied to the preceding group, the *Cicerinæ*. Some of the more obvious connexions have been already pointed out, and others will presently be mentioned. Indeed, so close is the relationship, and so important to Bartling did their affinities appear, that he combined the two sections, and from the beauty of their flowers he called them collectively the *Calophytes;* but it seems more advisable to keep them distinct, as such a course is sanctioned by nature, as well as pursued by the highest botanical authorities.

(2245.) The *Rosinæ*, as above enumerated, formed in the

Linnean fragments the 35th and 36th natural orders, *Senticosæ* and *Pomaceæ*. By Jussieu they were all comprehended in one primary group, the *Rosaceæ*, which he distributed into several subordinate divisions, nearly equivalent to the before-mentioned types. And although some modern botanists have loosened the bonds of their connexion, and elevated each subdivision to the rank of an independent order, their dissociation is not only in-



A. *Rosa canina*. Branch to shew the aculei, pinnate leaves and flowers.
(*a*) Section of a flower, the petals being removed to shew the urceolate calyx with its cleft limb, containing the pistils within the tube, and the stamens being exserted from the faux.
(*b*) The fruit.
(*c*) Section of ditto, shewing the included nuts.
(*d*) One of the nuts removed.
(*e*) Section made transversely.
(*f*) The seed.
(*g*) The embryo.
B. *Armeniaca vulgaris*. Branches shewing flower and fruit.
(*a*) Section of a flower shewing the perigynous stamens and terminal style.
(*b*) Section of fruit shewing the sarcocarp and putamen.
(*c*) The seed.
(*d*) Ditto separated to shew the two cotyledons.

expedient but unnatural, as their special differences can equally well be shewn without thus violating their general affinities: and hence, following the example of De Candolle, they are here sectionally combined, although typically distinguished, our *Rosinæ* being equivalent to his *Rosaceæ*, and our types to his subordinate tribes

(2246.) The *Rosinæ*, like the *Cicerinæ*, vary in their port, being herbaceous, shrubby, and arboreous plants, with alternate stipulate leaves; the stipules, as in the preceding section, being sometimes, though rarely absent, and the leaves both simple and compound. The inflorescence is various, and the flowers usually united. The calyx consists of 5 sepals, coherent by their claws, and often adnate with the germen, the fifth or odd sepal being axial or posterior. The petals are equal in number to the sepals, but sometimes (as in the Cicerinæ) abortive, and quincuncial in their æstivation. The stamina are perigynous, very rarely hypogynous, definite or indefinite, the filaments incurved in æstivation, and the anthers 2-celled, dehiscing by a double cleft. The carpels are several, or by

abortion solitary, and either free or concrete, and sometimes adnate with the tube of the calyx. The ovaries are 1-celled, and 1 or more ovuled. The styles are simple, mostly free, but occasionally united; either terminal, basal, or lateral in their exsertion, and the stigmata various in their form. The ovaries are sometimes spuriously 2-celled. The seeds are 1-2 in each carpel, (seldom more,) exalbuminous, (except in Hirtella and Neillia,) and either erect or inverted. The embryo is straight, and the cotyledons sometimes foliaceous, and sometimes thick and fleshy.

(2247.) Thus it will appear that the *Rosinæ* bear a very close resemblance to the *Cicerinæ,* not only in positive characters, but also in negative ones, for even the exceptions are similar; thus, in the occasional want of petals and stipules, the irregular and abnormal hypogynous stamens, the sometimes spuriously 2-celled ovaries, the rare presence of albumen, &c. they both agree.

(2248.) The points of similitude being so many, those of variance are but few, still they are sufficiently characteristic. And the *Rosinæ,* differentially considered, may be defined to be—Perigynous Rosales, or Myrtosæ, with stipulate leaves, a pentaphyllous calyx, the 5th or odd sepal being axial or posterior, the fruit a drupe, pome, or akenium, (not a legume,) the seeds exalbuminous, and the embryo straight.

(2249.) The Rosinæ, like the Cicerinæ, are distributable into three subsections, for the included types vary remarkably in the structure of the fruit; and, although not systematically essential, it is advantageous to note them as grades of structural development.

(2250.) Thus, in the three types, *Sanguisorbaceæ, Rosaceæ,* and *Spiræaceæ,* which may collectively be called the subsection *Rosianæ,* the fruit is acheniaceous.

(2251.) In the *Pomaceæ,* which is the only acknowledged type in the subsection *Pyrianæ,* the germen is inferior, and the fruit pomaceous.

(2252.) And in *Prunianæ,* including, in the *Prunaceæ* or *Amygdalaceæ* both the *Chrysobalanide* and *Amygdalidæ,* the fruit is drupaceous.

(2253.) The subordinate distribution of this group and the connexions of its several types and subtypes, may perhaps be most conveniently exhibited in a tabular form.

ROSINÆ.	ROSIANÆ	*Sanguisorbaceæ*	
		Spiræaceæ	*Quillajidæ* *Spiræidæ*
		Rosaceæ	*Rosidæ* *Neuridæ* *Fragaridæ*
	PYRIANÆ	*Pomaceæ* or *Pyruceeæ*	*Pyrenaridæ* *Pyridæ* *Dicalycidæ*
	PRUNIANÆ	*Prunaceæ*	*Amygdalidæ* *Chrysobalanidæ.*

And thus it will be evident that, by considering the types and subtypes which are the small natural orders of some modern writers as component parts of the larger one of De Candolle and Jussieu, whatever advantages may result from the comprehensiveness of the one or the precision of the others, will be here combined.

PRUNIANÆ.

(2254.) PRUNACEÆ. The almond (*Amygdalus*), the icaco or cocoa-plum (*Chrysobalanus*), and their respective allies, are shrubs or trees, never herbaceous plants, with simple, alternate, petiolate leaves, and free deciduous or caducous stipules.

The inflorescence is axillary or terminal, and the flowers, which are united, are disposed in spikes, racemes, or sertules; sometimes by abortion solitary, and either regular or irregular.

The calyx is 5-sepaled, the sepals either free or connate, and imbricate in æstivation; the fifth lobe being posterior or next the axis of inflorescence. The corolla is pentapetalous, and the petals (rarely abortive) are perigynous, and alternate with the sepals. The disk is united with the calyx. The stamens definite or indefinite, perigynous, the anthers 2-celled and dehiscing longitudinally. The ovary is free, by abortion solitary, 1-celled (or rarely spuriously 2-celled) and 2-ovuled, the style in one subtype, being terminal, with a reniform stigma, and in the other basal with a simple one.

The fruit is a drupe, with the putamen sometimes separating from the sarcocarp, 1, or rarely 2-celled; seeds mostly solitary, sometimes in pairs, erect in the first subtype and pendulous in the second. The albumen almost univerally absent. The embryo is straight, and the cotyledons large and entire, except in the albuminous Hirtellæ, in which they are foliaceous.

(2255.) Hence, differentially considered, the *Prunaceæ* are drupaceous *Rosinæ*, with free superior carpels, and terminal or basal styles.

(2256.) The genera here associated in the type PRUNACEÆ are distributable into two subtypical groups, often regarded as independent orders, and these, from Amygdalus and Chrysobalanus, the normal genera of each, are called the *Amygdalidæ* and *Chrysobalanidæ*.

(2257.) The *Amygdalidæ* (or Amygdaleæ) are *Prunaceæ*, with a deciduous 5-toothed calyx, regular petals, terminal style, pendulous seeds, and superior radicle.

(2258.) The *Chrysobalanidæ* (or Chrysobalaneæ) are *Prunaceæ*, with a persistent calyx often bracteolate at the base, and more or less coherent on one side with the germen. Petals more or less irregular, and sometimes absent. Stamens usually irregular, either in size or exsertion; basal style, erect seeds, and inferior radicle.

(2259.) *CHRYSOBALANIDÆ.* This border group is evidently transitional in its structure from the drupaceous *Detariaceæ* to the present section. The greater or less irregularity of the flowers, the cohesion of the stipulate ovary to the calyx, (as found in *Jonesia* and *Bauhinia*, § 2215,) and the irregularity of the stamens, are all so many repetitions of the leguminous structure in rosaceous flowers. The dryness of the drupes, which here are mealy, would seem also to indicate their near alliance to the half-succulent legumes, and to prepare the way through the almonds, to the succulent peaches, plums, and cherries.

(2260.) *Chrysobalanus* is a name which refers to the rich golden hue of several of the species. *C. Icaco* is the miscalled cocoa-plum of the West Indies. It is there commonly brought to market, and although not a very desirable fruit,

it is not unpleasant, and is eaten both in a fresh state and as a preserve. It has a sweet taste, but blended with a peculiar austerity. *C. ellipticus*, which is about

C

c. *Chrysobalanus Icaco.* Branch with leaves and fruit.

(*a*) Twig with flowers.

(*b*) Section of a flower, shewing the calyx, one petal of the corolla, the many perigynous stamens, and the single pistil with its basal style.

(*c*) Section of the ovary, to shew the two erect ovules and the basal style.

(*d*) Section of the fruit, shewing the sarcocarp and nut, or lithocarp.

(*e*) Section of the nut.

(*f*) One of the cotyledons with the gemmule at the base.

the size and colour of a damson, is eaten in Sierra Leone. The bark and root, as well as the seeds, of both species, are astringent, and emulsions made with the latter are said to be useful in diarrhœa and dysentery.

(2261.) The seeds of *Acioa Guianensis* are eatable; and the pulpy fruit of the *Parinaria*, as well as their seeds, are also esculent. *Parinarium macrophyllum* is the gingerbread-plum of Sierra Leone; and the negroes of Free Town are very fond both of it and of *P. luteum*, the yellow cocoa-plum, as well as of the rough-skinned or grey plum, *P. excelsum*. A sweet oil is procured from the fruit of *Acioa Guianensis:* and the bark of *Couepia Guianensis* is used by the natives in Guiana to bake their earthenware.

(2262.) *Hirtella*, a genus so named on account of the peculiar hairness of the branches, contains several species, of little or no economical importance. They are chiefly interesting from the circumstance of their having albuminous seeds and foliaceous cotyledons, a remarkable, but not a solitary deviation from the normal character of the section.

(2263.) AMYGDALIDÆ. Some of our most esteemed table-fruits, such as peaches, nectarines, apricots, and the various kinds of almond, cherry, and plum, are included in this subtype. This group is properly distinguished from the other Rosinæ, because it is remarkable for containing plants which, notwithstanding they all bear eatable fruits, furnish, from their leaves, their blossoms, and even their seeds, one of the most subtle and powerful vegetable poisons known. This deleterious principle, separated by modern chemistry, and named hydrocyanic or prussic acid, although so poisonous in a concentrated form, rarely exists in such proportion to the sugar, mucilage, and other innoxious substances, with

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which it is naturally combined, as to be in any degree injurious. Hence bitter almonds, peach and plum stones, and cherry laurel leaves, have long been favorite ingredients with cooks and confectioners, to give a pleasant flavour to custards, puddings, and jellies, and several of our most excellent liqueurs, such as noyau, ratafie, and maraschino, owe their flavour to this subtle poison.

(2264.) Some exceptions, however, do occur to the general rule above stated, for the leaves of several of the Amygdalidæ, to be enumerated hereafter, are deleterious to animals; and in a wild state even their fruit to man. Columella says that the Persians once sent a certain kind of peach to Egypt to poison the inhabitants; and Shaw informs us that, in Barbary, there is a kind of apricot called "*Matza Franca*" or the Christian-killer, probably from its fruit being employed for the purpose noted by its fearful name.

(2265.) The cherry was included by Linneus in the same genus with the plum. But, as the Linnean genera were often rather orders than real generic groups, modern botanists have found it advisable to revert to the distinctions acknowledged by Miller, between the cherry and the plum, and which have always been popularly maintained; for not only do they differ in the shape of the stone, but the drupes of the former are smooth and shining, while those of the latter are pruinose, or covered with a resinous secretion, commonly called bloom.

(2266.) But even the cherries thus separated from the plums both need and admit a further subdivision, as they differ greatly both in their properties and their habits, as well as in their structure. Hence the genus *Cerasus* has been by some botanists divided into two or three genera; but, as the structural differences occur in the organs of vegetation, they are perhaps with more propriety considered only subgeneric groups, and as such alone they are admitted here.

(2267.) In (*Cerasus*) the true cherry the inflorescence is in tufts or sertula, not in racemes. In the cherry-laurel (*Laurocerasus*) the flowers and fruit are in racemes, and the leaves are evergreen. While in *Padus*, a group sometimes separated from *Laurocerasus*, and sometimes combined with it, although the inflorescence is racemose, the leaves are deciduous. These subgeneric distinctions are more important in an economical than in a systematic point of view, for prussic acid, which abounds in the *Laurocerasi*, even in their leaves, is almost absent from the true cherries, or *Cerasi*, and in the intermediate *Padi*, it occurs only in very moderate proportions.

(2268.) The cherry is commonly reported to have been brought to Rome in the year 680 U. C., by Lucullus, from Cherasond, a city of Cappadocia, where the fruit then greatly abounded; but whether they were called *Cerasi*, from the place where they were then so plentiful, or gave their name to the town, is a point both of doubt and of dispute: the Persian word for cherry, is *Keras*. Pliny says that cherries were greatly esteemed by the Romans; and such was the general fondness for the fruit, that "in less than 120 years after their introduction into Italy, other lands had cherries, even as far as Britain, beyond the ocean." (Lib. xv. c. xxv.) It is, however, generally believed that the cherry is indigenous to this country and to France; for it has been found wild in such situations, especially in Scotland, as scarcely to admit a doubt, were it not that cherries and plums are of all seeds the most widely spread by birds.

(2269.) The fruit of all the true *Cerasi* (or as they are called, by Necker and De Candolle, *Cerasophoræ*,) is eatable and innoxious: but the bird-cherry (*C.*

Avium), the heart-cherry (*C. Duracina*), the gean-cherry (*C. Juliana*), and the round-cherry (*C. Caproniana*), with their respective varieties, especially those of the latter, are the ones chiefly in cultivation.

(2270.) *C. Avium* is not much esteemed as a fruit, but one variety, *C. multiplex*, is cultivated as an ornamental plant under the name of the double-blossomed cherry; and it is physiologically interesting for the admirable example it affords of the change of the seed-vessel into leaves. A large fruited variety, called the *Kirschenwasser* tree, is grown in the Black Forest, in Alsace, and in Switzerland, from which a spirit, or kind of cherry-brandy, is distilled. Another variety, the *Marasia*, is cultivated in Dalmatia for the manufacture of the delicious liquor, thence named *Maraschino;* and it also enters into the composition of *Ratafia.*

(2271.) The several varieties of *C. Duracina* are well known as Bigarreaux, and as the numerous kinds of black, white, red, yellow, and bleeding-heart cherries, some of which are first-rate table fruits. Their pulp, however, is hard and fleshy, whence their name *Duracina*, and they are consequently very indigestible.

(2272.) Of *C. Juliana*, the black-eagle and the amber-gean, are the best varieties; the Hungarians are second-rate fruits, and the All-saints or weeping cherry (*C. pendula*), is more curious than useful.

(2273.) The Morellos, the May-dukes, and the Arch-dukes, with the Honey, the Kentish, and many other ducal kinds of cherry, well known in our markets, are all varieties of *C. Caproniana.* The fruit afforded by these is the finest and the most useful for dessert and preserves of either of the species; and from the flesh being less firm, they are more agreeable and wholesome.

(2274.) The Romans possessed only eight varieties of cherry: upwards of 200 are now known, according to the catalogue published by the Horticultural Society of London, in which 219 are enumerated, and above forty are commonly cultivated in our gardens and orchards. Such has been the triumph of art; and such a few of the comforts and luxuries it bestows on man.

(2275.) *C. hyemalis* has a black and astringent fruit, that is eatable only in winter.

(2276.) *Padus*, a name adopted from Theophrastus (*παδος*), is given to those species of cerasus which have a racemose inflorescence and deciduous leaves, a group intermediate between the subgenera *Cerasophora* and *Laurocerasus*, agreeing with the former in the deciduous foliage, and with the latter in their racemose flowers and fruit.

(2277.) *P. vulgaris* (or *Avium*) is the fowl-cherry, or hagberry of Scotland. The fruit is nauseous to most palates, but in Siberia it is eaten for want of a better; and, when steeped in whisky or gin, it greatly improves the flavour of those spirits, and even approaches them in delicacy to some of the foreign liqueurs. In Finland a decoction of the bark is used medicinally.

(2278.) *P. Mahaleb* yields a hard red sweet-scented timber, much esteemed by cabinet-makers, and known in commerce as St. Lucia wood. Its fruit is black, and yields a purplish juice, the stains of which are not easily effaced. A fragrant water is also distilled from both leaves and flowers.

(2279.) *P. pseudocerasus*, the *Yung-to* of the Chinese, has only lately been introduced into this country. It has a pleasant eatable fruit, and promises to become a valuable plant as it bears forcing well, and yields abundant crops in our houses.

(2280.) *P. serotina* is the choke-cherry of the Cree Indians; and, although its fruit is scarcely esculent in a fresh state, when dried and bruised, it is esteemed by them as food, and added to their *pemmican*.

The bark of *P. Capolin* is used in Mexico, as a febrifuge.

(2281.) *P. Capricida* is the goat-bane of Nipaul: so called on account of its leaves containing so much prussic acid as to destroy those animals when they browse upon it. Don says this plant is probably an evergreen, and if so it should be arranged along with the other sempervirent species in the following subgenus, which is, like it, remarkable for the prevalence of prussic acid in the leaves.

(2282.) *Laurocerasus* includes all the *Cerasi* which have a racemose inflorescence and evergreen leaves. These plants are commonly known as laurels, or rather cherry-laurels, having as it were the fruit and flowers of cherries, with the foliage of the bays or laurels.

L. vulgaris (*Cerasus Laurocerasus*), is the common laurel of our gardens; *L. Lusitanica*, is the Portugal laurel; *L. Braziliensis* and *Caroliniana*, the Brazilian, and *Carolina* laurels. These are all hardy ornamental evergreens, the leaves of which are frequently boiled in custards and jellies, to give them the flavour of bitter almonds. They should, however, be employed with caution, as accidents have occurred from their too free use. The case of Sir Theodosius Boughton has rendered the poisonous properties of laurel-water familiar to every one, and the fear it excited has unnecessarily extended the evil character of the leaves to the fruit, which is harmless; and, although not pleasant, is in some places made into puddings. Indeed, the common cherry laurel was first sent from Constantinople, under the name of the "Date of Trebisond," as it grows wild in Asia Minor, in the neighbourhood of that city. And here, although seldom used as human food, birds eat both the pulpy part of the drupe, and even the kernels, without any ill effects being perceived; but, as these latter have a strong smell of bitter almonds, they should be taken in moderation, and not introduced in too large quantities into the liqueurs, teas, and chocolates, which, on the continent, are sometimes flavoured with them.

(2283.) The Sloe, the Bullace, and all our garden kinds of Plums and Damsons, belong to the genus *Prunus*, and are most of them varieties of one species, *P. domestica*, which is itself by some authorities declared to be only the *P. spinosa*, or sloe, improved by cultivation; but, however this may originally have been, the difference is now so great, that it is as well to consider it specific.

(2284.) *P. spinosa* is the sloe, or blackthorn of our hedges; the fruit is remarkable for its acerbity, and has been recommended as an astringent in medicine. The chief use of sloes is, however, in the manufacture of British port, and in giving to home-made wines the roughness of those which are brought from Oporto. The leaves have also been dried as a kind of tea, and mixed in large proportions with that imported from China. From the result of a parliamentary investigation, it appears that upwards of four million pounds of fictitious tea are on an average annually made in this country, and used to mix with that brought here from China. And within a few years this illicit practice, which had previously been carried on by stealth, was attempted to be legalized by taking out a patent for the preparation of British leaves as a substitute for tea, and an extensive manufactory established for the purpose. But it soon became notorious, that whatever might have been the original intention of the patentee, the 'prepared

British leaf' was not sold retail, and used as such, but was purchased by fraudulent grocers to mix with and adulterate China tea; for it was traced in large quantities from the manufactory to different grocers' shops, and seized by the officers of excise, both in its unmixed state, and mixed with foreign teas. Hence the manufacture has been suppressed; and a short time since, upwards of five and forty hogsheads of leaves, in different stages of preparation, were condemned by Sir Peter Laurie, the then lord mayor, and burned. An account of the proceedings with notes of the botanical examination of the leaves, was read at a late meeting of the Medico Botanical Society of London, and will probably be published in their Transactions.

The inspissated unripe juice of the sloe is used in Germany as a marking-ink.

(2285.) Of the Bullace (*P. insititia*), there are several varieties, differing chiefly in colour, and known as the black, the white, and the waxen. They are too rough and sour to be pleasant when raw, but, made into a conserve or tarts, with abundance of sugar, they are much esteemed.

The flowers of this and the preceding species are said to be mildly laxative, and their bark astringent. The bark of *P. Cocomilia*, a native of Calabria, is extolled by Tenore as a powerful febrifuge.

(2286.) Of the garden plum (*P. domestica*), there are nearly 300 known varieties. Of these the apricot plums, the gages, both green and yellow; the egg, (cr *magnum bonum;*) the cherry, the imperial, the Saint Catherine, with the several sorts of damsons, are the most generally cultivated and esteemed. Plums, when fully ripe, are very delicious fruits, and far less unwholesome than they are generally esteemed; but, to bring on dyspepsia, no better scheme can be devised than to have pies and puddings made of half-ripe fruit, rendered just eatable by being cooked, with a quantity of sugar.

(2287.) Dried plums, under the name of prunes, French plums, &c. are imported in considerable quantities to this country from various parts of the continent.

(2288.) The apricot, once considered a species of prunus, is now formed into a genus called *Armeniaca*, on account of the common sort having been originally brought from Armenia. Our word apricot, formerly spelt *Aprecock*, and by our earliest writers *A-precoke*, is said to be a corruption of *Precox;* the *Malus Armeniaca* of the ancients, being so called on account of the early ripening of the fruit. But such an etymology is more whimsical than probable, and especially when we know that in Arabic its name is *Berikach*, or *Bercoch*, whence the Greeks probably derived their *περικυκκα*, the French their *Abricot*, and we our *Aprecock* and *Apricot*.

The apricot is a very delicious fruit, and generally considered as only inferior to the nectarine and the peach. In Persia it is so much esteemed, that in the figurative language of the East it is called '*the Seed of the Sun.*'

(2289.) From the kernels of several species, the pulp of which is of inferior quality, a fixed oil is extracted, and the '*huile de marmote*' of *Briancon*, is expressed from the seeds of *A: Brigantiaca*. There are many varieties of apricot, upwards of 40, which are distinguished by having sweet or bitter kernels, large and small fruits, and being either *free-stones*, or *cling-stones*, &c.

(2290.) The peach and nectarine, once considered only as varieties of

almond, are separated on account of their fleshy mesocarp, and irregularly furrowed (lithocarp, or) stone, from the coriaceous almonds, which have a fibrous mesocarp, and a smooth or pitted putamen, and formed into a distinct genus, called *Persica,* because these valuable fruits were originally brought from the vicinity of Ispahan. Whether these differences may have been aboriginal or not, they are now sufficient, and appear sufficiently permanent to render the generic separation advisable; and the same may be said of the specific distinctions between the nectarine and the peach, which some persons still contend are but varieties of each other; and the circumstances are such as render the point debateable.

(2291.) There are many varieties of the peach, (*Persica vulgaris,*) perhaps upwards of a hundred, which are distributed into several tribes and families. 1st. The free-stone or melting-peaches, including all those in which the pulp or flesh separates easily from the stone; and 2d. the cling-stone peaches, comprehending, as the name imports, all those in which the flesh clings, or is adherent to the stone. The former are *Les pêches,* the latter *Les pavies,* of the French.

(2292.) In many parts of the United States the peach-trees grow in extensive plantations, the orchards almost resembling forests. But as they are nearly wild in their growth, and not improved by culture, the fruit is of little value, except for the distillation of peach-brandy, and for fattening hogs. Captain Head mentions, in his 'Rough Notes,' the productiveness and beauty of the peach-trees, which abound among the corn-fields of Mendoza, on the eastern side of the Andes; and he says that, in the mountainous districts, dried peaches are used as an article of food.

(2293.) The peach flowers are mildly laxative, and peach flower or peach leaf-tea from the prussic acid contained, have been recommended as vermifuges; emulsions made of peach kernels are also, for the same reason, occasionally very useful in allaying the irritability of the mucous membranes of the air passages, and relieving pectoral complaints. It is needless to say any thing of the value of the peach as a dessert.

(2294.) Of the nectarine, (*P. lævis,*) there are many varieties, although not so many as of the peach. They are, like their associates, distributable into two chief tribes. 1st. The free-stone or melting nectarines, called *Brugnons* by the French. And 2d, the cling-stone nectarines, or *Pêches-violettes* of the Parisian gardeners.

The nectarine is universally admitted to be superior even to the peach; and Forsyth says, that on account of its exquisite flavour, "the fruit is called nectarine, from nectar, the poetical drink of the gods."

(2295.) The genus Amygdalus is now very properly restrained to the several species of almond, of which there are only 6 or 7 at present known. *Amygdalus communis,* the common almond, is the most important of these, and of it there are several varieties, such as the bitter, the sweet, the sultana, and others. The *A. persicoides* is believed to be a hybrid, arising from the flowers of the almond having been fertilized by the pollen of the peach. This peach almond is thought by some persons to be the one said to have been sent as a poison by the Persians to the Egyptians; but the tale has probably arisen from the circumstance of the

climate of Egypt being unfavourable to the growth of peach-trees, and the development of the fruit.

(2296.) The almond is indigenous to the northern parts of Africa and Asia, and is mentioned in Scripture as one of the choice fruits of Canaan; but, although now cultivated commonly throughout Italy, France, and Spain, it does not seem to have been introduced so early as the peach: for in the time of Cato, almonds were called 'Greek nuts.'—[*Nuces Græcæ.*]

(2297.) Almonds form a very nutritious but not easily digestible food. They are imported in large quantities into this country from Spain, Barbary, and the Levant. The Syrian or Jordan almonds are preferred for dessert. The others are chiefly used in confectionary and as a source of oil; the fixed or expressed oil, whether from the sweet or bitter almond, is equally mild and innocuous; but the latter affords, by distillation, a volatile or essential oil, strongly impregnated with prussic acid, which is a violent poison. It is however likewise a useful medicine, (*vid. Med. Bot.* 43 and 117,) and in moderate quantities a most pleasant addition to confectionary and liqueurs. The annual imports of almonds average upwards of 600 tons. Almonds, as M'Culloch says, are among the most grossly overtaxed articles of the British tariff. The duty on Jordan almonds amounts to 4*l.* 15*s.* a cwt., about 95 tons being annually imported. The duty on bitter almonds is more than their value in bond; but were it less, the revenue, which now, notwithstanding the almost prohibition duties, receives 18,610*l.* per annum upon this article alone, would probably have the nett produce trebled. M'Culloch says it would be increased fivefold.

(2298.) The timber of the larger plums and cherries, some of which attain a considerable size, is hard, close-grained, and durable. The damson, the apricot, the bird-cherry, and the plum, have beautifully veined woods, and are much esteemed for fancy works. The wood of such as grow wild is closer and more valuable than when the trees are cultivated. The bark of the plum is occasionally used as a yellow dye.

(2299.) All the *Amygdalidæ* yield a peculiar gum resembling that afforded by certain *Astragali*, such as *A. verus* and *Tragacantha*, and which is known as cherry-tree gum. It consists chiefly of a peculiar principle called *Cerasin*, although not so free from admixture as gum-dragon, which is *Cerasin* almost pure.

PYRIANÆ.

(3000.) All the *Pomaceous* Rosinæ are included in this subsection, and the genera are so few in number, and for the most part so similar in structure, that they are usually associated in a single type, called, from the general character of the fruit, *Pomaceæ;* but as two of the genera (*Dicalyx* and *Pyrenaria*) deviate from the normal structure, the former by having a drupose fruit, and the latter by having hypogynous stamens, an inferior calyx and free germen, they should be regarded as typical of two other co-ordinate groups, either types or subtypes, rather than as exceptions to the present; for which *Pyraceæ* would be a better collective name than *Pomaceæ*, which it now enjoys: and the more especially as all are not apple-bearing plants which are associated here.

(3001.) Pyracræ or Pomaceæ. The Apple, Pear, Quince, Hawthorn, and Medlar, which, with their allies, the plum-apple, cherry-apple, &c. that are asso-

ciated to form this type, are trees or shrubs, never herbaceous plants, with roundish branches, sometimes converted, by the abortion of the buds, into spines. The

A. *Cydonia vulgaris, (Pyrus Cydonia.)* Branch with leaves and fruit.
(*a*) Flower separated, to shew its pentapetalous corolla and erect stamens.
(*b*) Flower with petals and stamens removed, shewing the superior or adherent calyx, and 5 styles.
(*c*) Fruit, a closed pome.
(*d*) Section of the pome, to shew the adherent tube of the calyx, and ascending seeds.
(*e*) A seed.
B. *Sanguisorba media.* Branch with leaves and glomerules of flowers.
(*a*) Flower separated and magnified, to shew the bracteæ, one of the calycine scales, the tube of the perianth, and its limb, sometimes called a corolla, the 4 stamens and pistil.
(*b*) Section of a flower, to shew the calycine scales or calyx, the perianth, the stamens, ovary, &c.
(*c*) Enlarged calyx investing the pericarp.
(*d*) Section of the persistent calyx, to shew the pericarp.
(*e*) The seed.
(*f*) The embryo.

leaves are alternate, petiolate, either simple or compound, and furnished with free caducous stipules. The inflorescence is terminal, corymbose or sertulate, rarely cymose or solitary; and the flowers, either white or pink, are united, or rarely by abortion separated.

The calyx is urceolate or campanulate, the tube more or less adherent to the germen, the limb marcescent or deciduous, 5-lobed, the fifth sepal being posterior, and imbricate in æstivation. The torus usually unites the calyx and carpels. The petals are 5, with short claws, and exserted from the torus or calyx, the fifth being anterior or distant from the axis of inflorescence. The corolla is regular, rarely abortive, and imbricate in æstivation.

The stamens are numerous, subdefinite, usually about 20, and exserted with the petals, (in Pyrenaria alone being hypogynous.) The filaments are free, and the anthers 2-celled, with a longitudinal dehiscence. The germen more or less covered by the torus and the calyx. The ovaries from 1-5, are one or spuriously 2-celled, and more or less coherent. The ovules definite, very seldom solitary, usually 2, collateral, (which is a distinguishing character of this type, for, in *Rosaceæ*, when the ovules are ascending, and 2 or more in number, they are not collateral, but placed one above the other): the styles equal in number to the carpels, and the stigmata simple.

The fruit is inferior, (very rarely superior,) pomaceous, occasionally becoming drupaceous, 1-5-celled, sometimes spuriously 10-celled, the endocarp of the carpels being either spongy, cartilaginous, or bony. The seeds are solitary, (by abortion,) ascending, the trophosperm short and ending in an oblong chalaza, and

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the albumen wanting. The embryo is straight, the radicle short and conical, the plumula inconspicuous, and the cotyledons flat or convolute, large, entire, and foliaceous during germination.

(3002.) Hence, differentially considered, the *Pyraceæ* are pomaceous *Rosinæ*, with more or less coherent carpels, and definite collateral ovules.

(3003.) The deviations from the normal structure that occur in *Dicalyx* and *Pyrenaria*, point them out as typical of two osculant subtypes, the *Dicalycidæ* and *Pyrenaridæ*, which connect the *Pyridæ* or true *Pomaceæ*, with the preceding drupaceous, and the succeeding acheniaceous, types.

(3004.) The *Dicalycidæ* are subdrupaceous *Pyrianæ*, with a catapetalous corolla; an inferior ovary, 3-celled and multiovulate; the seeds albuminous, by abortion solitary, and pendulous; and the embryo inverted and slightly incurved.

(3005.) The *Pyridæ* are pome-bearing *Pyrinæ*, with inferior ovaries, seeds solitary, ascending and exalbuminous; and the embryo erect and straight.

(3006.) The *Pyrenaridæ* are subpomaceous *Pyrianæ*, with an inferior calyx, subperigynous stamens, superior fruit, exalbuminous seeds, and erect embryo, with contortuplicate cotyledons.

(3007.) *Dicalycidæ.* The superior perianth adhering by its tube to the ovary, which is crowned by the persistent limb, renders the fruit of *Dicalyx* rather a pome than a drupe; and hence it forms the osculant genus between the Prunaceæ and the present type. *Hirtella*, of the *Chrysobalanidæ*, it will be recollected, has, like it, albuminous seeds; thus strengthening the alliance by a common exception.

(3008.) *Dicalyx* has received its generic name from the calyx being calyculate, or closely invested by bracteæ, which makes the organ in question appear double. The several species known are natives of Java and Cochin-china, and in the last-named country the wood and leaves of *D. tinctorius* and *aluminosus* are much used as yellow dyes.

(3009.) *Pyridæ.* The various kinds of hawthorn, such as the May or white-thorn, the scarlet-thorn, the cockspur-thorn, the fire-thorn, &c. are all species of Cratægus, so called, it is said, on account of the strength of their wood, or the impenetrable hedges they are fitted to form. The chief use made of these plants is in the construction of fences; for, although thorn timber is very hard and durable, it is of slow growth, and seldom to be obtained of a serviceable size. The hardness of the wood is evident, from the circumstance of its often being used as wedges to split other timbers. The fruit is eatable, but it has the pulpy part so little developed as scarcely to be a desirable food. But *C. Azarolus* is an exception; for it is much esteemed as a dessert in the South of Europe and the Levant. The bark of several species, as of *C. oxyacanthus*, &c. is bitter, and has been substituted for cinchona. They are all very ornamental plants, especially the May or white-thorn, the scarlet-hawthorn, and the pyrecantha or fire-thorn, the red berries and evergreen foliage of which render it a great favorite in gardens.

(3010.) The bark of *Photenia dubia* is used in Nepal to dye cotton of a red colour; and *Eriobotrya*, the *Loquat* of Japan and China, is esteemed in those countries for its fruit, which is agreeably acid, like the apple, and is said by Sir Joseph Banks to be equally good with the mango. It is occasionally cultivated in this country, to give variety to our desserts.

(3011.) The medlar (*Mespilus Germanica*) is a well known European fruit, very much resembling the haws of the Cratægi. Its unclosed pomes are, however, far more pulpy, but they are not esculent until partially decayed. Their smell and taste are peculiar, and in general much esteemed.

(3012.) The Savoy-medlar (*Amelanchier vulgaris*) is a native of the South of Europe; its fruit is eatable, but inferior to that of some Canadian species, especially *A. sanguinea* and *ovalis*. The latter, Dr. Richardson informs us, "abounds on the sandy plains of the Saskatchawan. Its wood, called by the Crees *Meesass-quat-ahtick*, is prized by them for making arrows and pipe-stems; and is thence termed by the Canadian voyagers "*bois de flèche*." Its berries, about the size of a pea, are the finest fruit in the country, and are used by the Crees under the name of *Meesass-cootoommeena*, both in a fresh and dried state. They make excellent puddings, little inferior to plums, and are a pleasant addition to the pemmican of the country. This genus is remarkable for having a 10-celled ovary, each of its 5 carpels being spuriously 2-celled.

(3013.) *Cotoneaster*, a genus separated from *Mespilus*, is chiefly interesting from the circumstance of one species, viz. *C. microphylla*, containing prussic acid: thus establishing, by properties as well as by structure, the affinity of the contingent types.

(3014.) The apple, the pear, and the service, are included by modern botanists in a single genus; and to the former two the quince was added by Linneus, who excluded the service. But the popular distinctions which were recognised by Tournefort are so convenient, that even, if not adopted as genera, they may well be admitted as subgeneric groups. And as, the several species of Pyrus, like the Cerasi, chiefly differ in their mode of inflorescence, the secondary characters will be founded upon it.

(3015.) Thus, in the apple and pear, the flowers are collected in sertula or simple umbels, while in the service they are never sertulate, but arranged in racemes or corymbs. And furthermore, the apples are distinguished from the pears, by the styles in the latter being free, and the turbinate fruit not umbilicate at the base, for in the former the styles are subcoalescent, and the peduncle enters a basal umbilicus in the pome.

(3016.) Hence the true pears, in the subgenus *Pyrophorum* or *Pyrus*, have sertulate flowers, free styles, and no basal umbilicus.

(3017.) The apples, forming the subgenus *Malus*, have sertulate flowers, and the pome with a basal umbilicus.

(3018.) And the services and their allies, forming the subgenus *Sorbus*, which is often again distributed into several sections, have their flowers non-sertulate, and arranged in corymbs or racemes.

(3019.) Of the subgenus *Pyrophorum* or *Pyrus* there are only eighteen known species, but of one of these, *P. communis*, the varieties and subvarieties are almost innumerable. *P. Achras*, one of the chief varieties, is the choke or iron pear, well so named from the hardness of the fruit, and its effects when eaten; both it and *P. Pyraster* are very thorny when growing wild, but lose all their spines when under culture, and become tamed. Their fruit likewise undergoes a no less remarkable amelioration, changing its acerbity and hardness for a soft and luscious flesh. The Romans had about thirty-six sorts of pears; we have several hundred: in the list published by the Horticultural Society, 677 differ-

ently named pears are enumerated. These multitudinous varieties are classed for economic purposes into dessert, perry, and baking-pears; and the former again into *Beurrés* (butter or melting-pears), and *Crevers* (or breaking-pears.)

Pears are much valued as a dessert; they are also dried as a winter fruit; and an intoxicating liquor is prepared by fermenting their expressed juice, and is familiar to all as perry. In this country the manufacture of perry is chiefly confined to Worcestershire, and three pears form the armorial bearings of the provincial city. The continental pears are on the whole superior to those grown in this country; but, from the accounts received from China, it would seem that there they far exceed, at least in size, any produced in Europe; for Marco Paulo says the Chinese have pears white inside, fragrant, melting, and of the enormous weight of 10 lbs each.

(3020.) Of the eleven known species of apple (*Malus*), two only are of much economical importance, and these are generally confounded together under the common name of *Pyrus Malus*, or crab. They are, however, distinguished by De Candolle; the one, *Malus acerba*, having a smooth calycine tube, while in the other, *M. mitis*, the tube of the calyx is downy. The former, the *Pommier à Cidre* of the French, he considers to be the origin of our cider fruit, and the latter, the *Pommier doux* or *Pommier à couteau*, to be the source of our eating apples. Others, however, contend that these two species are but varieties of each other, and that all our numerous cultivated kinds are deviations from a common stock, the *Pyrus Malus*, or *Malus sylvestris*, which includes both *M. acerba* and *M. mitis*.

(3021.) The fruit of the various kinds of apple abound with an acid called the malic, which is more or less predominant, and mixed with larger and smaller proportions of sugar, gum, essential oil, and bland pulpy matter; and hence all the varieties of taste and smell for which apples are remarkable. The expressed juice of the unripe apples, especially of the wild-crab, is exceedingly sour and austere; it is commonly known as verjuice, and is often kept by notable housewives and village doctresses to cure sprains and scalds.

(3022.) Between one and two thousand cultivated varieties of apple are known: 1400 have been registered by the Horticultural Society of London, in their valuable catalogue. These may be distributed, according to their uses, as dessert, kitchen, and cider fruit.

(3023.) The apple is a fruit of great economical importance; and it is peculiarly valuable, from the length of time that many of the varieties will keep, furnishing our tables and kitchens throughout the winter, and lasting in perfection even till the spring fruits are ready for use. The chief cider districts in England lie in the form of a horseshoe round the Bristol Channel, and the orchards in the counties of Devon, Somerset, Worcester, and Hereford, are most extensive. The duty having been taken off cider, it is difficult to calculate the quantity now made; but as in 1830, when each barrel paid 10*s.* to the excise, nearly 80,000 barrels of cider and perry were entered, besides what was clandestinely manufactured, it is probable that nearly 100,000 barrels will be the annual average, one fourth of which may be perry and three fourths cider. The best Hereford cider and perry is exported to the East and West Indies and America, where it is more prized than with us at home. From twenty-five to thirty bushels of apples are required to make one hogshead of cider.

(3024.) Besides the ordinary purposes to which apples are applied, M. Duduit has found that one third of boiled apple pulp baked with two thirds of flour, having been previously fermented with yeast for twelve hours, will make an excellent bread, very palatable and light.

(3025.) *Malus spectabilis* or the Chinese crab, is a very shewy ornamental plant. Its buds are of a fine red hue, and its double blossoms a rich pink. The Siberian crabs, *M. prunifolia* and *baccata*, are also rather ornamental than useful plants. The fruit of the former, like the medlar, is rendered more palatable by incipient decay, and the latter is used for making quasar punch in Siberia. Both form an excellent preserve when boiled and candied in sugar.

(3026.) Of the different species arranged in the several sections of the sub-genus *Sorbus*, the following are the most important: *S. Aria*, the beam-tree, the wood of which is so tough and hard as to have been, from the earliest ages, much valued for axles, shafts, &c.; whence indeed its name. *S. edulis*, the eatable service, the fruit of which is sapid and pleasant; *S. torminalis*, so called from the griping pains it produces in the bowels when eaten before the fruit has been touched by the frost, after which it becomes more wholesome; *S. Aucuparia*, the mountain-ash, which, under the names of the roan, roddon, quicken, or witchen-tree, figures so prominently in many old superstitions. It is supposed to have been one of the druidical sacred trees. It is called the "fowler's service," (*Aucuparia*,) from the use that is made of its berries as a bait for birds. Its bark is astringent, and is employed by tanners. The berries afford a dye; and their juice, when fermented, form an intoxicating liquor, that yields a strong spirit on distillation. *P. domestica* is the household service, the use of which, in cookery, is now all but obsolete. Its wood, which is hard, is valued by mathematical instrument makers, and is generally the material of which rulers and excisemen's gauging-sticks are made.

(3027.) The quinces, once considered species of Pyrus, are now associated in a genus called Cydonia, a name which refers to Sidon, the native place of the best known species. The common quince, *C. vulgaris*, has a strong and rather an unpleasant smell, and if eaten alone, far from agreeable taste; but, when mixed with apples in tarts, it gives to them a most delicious flavour. Quince marmalade is also excellent, and in Gerarde's time it seems to have been in very general use. Quince seeds abound in mucilage, and hence they are occasionally used in medicine as a demulcent.

(3028.) The *C.* (olim Pyrus) *Japonica* is a very ornamental shrub, and much prized in gardens for its brilliant scarlet blossoms: but its fruit is not esculent. *C. Sinensis* is also a very elegant plant, remarkable for the number and the brilliant whiteness of its flowers.

(3029.) The apple and pear are very long-lived trees, and their timber hard and durable, and esteemed both for ornamental and useful purposes: but their fruit is in general too important to allow them to be cut for the sake of their wood.

(3030.) PYRENARIDÆ. *Pyrenaria serrata*, which is a native of Java, is a plant having the habit of the *Pyraceæ*, but deviating in several important particulars from the normal structure of the type. These variations have been already pointed out [§ 3000-6]; and Don suggests an affinity with *Ternstroemia*. But the inferior calyx may perhaps be better esteemed a preparation for the free ovaries of the *Rosaceæ;* and the hypogynous exsertion of the stamens is only a repetition here of what occurs several times among the *Ciceriną*.

ROSIANÆ.

(3031.) The three types, *Spiræaceæ*, *Rosaceæ*, and *Sanguisorbaceæ*, which agree in having for the most part dry and akeniaceous fruits, are, for convenience, associated in a subsection that may be called *Rosianæ*, from the most important and best known genus; which has already given name to the section, the order, and the class. These subsections, however, both here and elsewhere, are merely convenient demarcations, and are by no means to be regarded as separating the types; and the distinctive characters are only general; for, just as the connexion is shewn between the normal *Amygdalidæ* and *Pyridæ* by Dicalyx, so the *akenia* in *Rosa* are invested with a succulent calyx, that simulates a pome; and the mesocarp of each *acinus*, in the aggregate fruit of *Rubus* becomes succulent, forming a drupeola: thus a double alliance is established with both the preceding types.

(3032.) Differentially considered, the *Rosianæ* are therefore akeniaceous *Rosinæ*, the ovaries being superior, and the fruit rarely becoming drupaceous or capsular.

(3033.) Rosaceæ. The rose, the strawberry, and their allies, which are associated to form this type, are herbaceous or shrubby, but never arboreous plants, with alternate leaves, either simple or compound, and almost universally furnished with stipules. The inflorescence is variable, the flowers monoclinious, rarely by abortion separated; very prone to become double, and in colour red, white, or yellow, but never blue. The calyx is 4-5 sepaled, the sepals more or less connected, and valvate or imbricate in æstivation: the fifth or odd lobe being axial or posterior. The torus is variable, sometimes forming an annular disk, at others becoming large and hemispherical, or lining the urceolate tube of the calyx. The petals are equal, with short ungues, perigynous, 5 in number, and rarely absent. The stamens are indefinite, perigynous, exserted within the petals, and incurving during æstivation. The filaments are free, the anthers innate, 2-celled, and dehisce longitudinally. The ovaries are several, superior, mostly free, rarely cohering either with the calyx or among themselves, 1-celled, and 1-seeded; the ovula suspended, (seldom erect.) The styles are lateral, exserted just below the apex of the carpel, and the stigmata simple and emarginate on one side. The fruit either 1-seeded nuts or akenia, occasionally becoming drupeolæ. The seeds pendent, rarely ascending. The albumen in general absent, being obliterated when the seeds are ripe, in all except Neillia. The embryo is straight, the radicle short, taper, and pointing towards the hilum; and the cotyledons flat and entire, and foliaceous during germination, [§ 2245. a.]

(3034.) Hence, differentially considered, the *Rosaceæ* are polypetalous *Rosinæ*, with superior simple ovaria and lateral styles. The fruit akenia or drupeolæ, and the seeds solitary and exalbuminous.

(3035.) The Rosaceous genera are distributable into two subtypes, which,

from the strawberry and the rose, are called the *Fragaridæ* and *Rosidæ;* and to these a third is usually added, containing only the single genus *Neurada;* but the propriety of its location here is doubtful.

(3036.) The *Fragaridæ* are *Rosaceæ* with valvate sepals, carpels numerous and free, fruit either dry akenia or succulent drupeolæ, surrounded by the dry persistent calyx.

(3037.) The *Rosidæ* are urceolate *Rosaceæ* with the lobes of the calyx spirally, imbricate in æstivation, and the fruit a cynarhodon; that is, the nuts or akenia contained with the succulent tube of the persistent calyx.

(3038.) The *Neuridæ* are suffrutescent Rosales, with a 5-cleft calyx valvate in æstivation, and partially adherent to the ovary. Stamens and petals perigynous, and the carpels 10, cohering so as to form a 10-celled capsule; and the seeds, which are solitary, obliquely pendulous with curved embryos, and exalbuminous, germinate before quitting the capsule.

(3039.) FRAGARIDÆ. (*Potentilleæ, Dryadeæ.*) Rubus, Fragaria, Dryas, Potentilla, Comarum, Agrimonia, and the other genera associated in this sub-type, are for the most part astringent, and all of them innocuous plants; several,

Fragaria Indica.

c. Shoot with leaves, flower and fruit.

(*a*) Vertical section of a flower, shewing the torus, with the numerous carpels, the perigynous stamens, petals, &c.

(*b*) Vertical section of the fruit, consisting of the enlarged succulent torus beset with akenia.

(*c*) Pistil, shewing the lateral exsertion of the style.

(*d*) Akenium, 1-celled and 1-seeded.

(*e*) Longitudinal section of ditto.

(*f*) Exalbuminous embryo, with large plane, entire, cotyledons.

such a the strawberry, raspberry, &c. afford eatable fruits; but those of the majority, although not poisonous, are unfit for food.

(3040.) *Rubus*, the bramble, is an extensive genus, containing about 150 known species, of which our raspberries, blackberries, dewberries, and cloud-berries, are the most familiar examples.

(3041.) *R. Idæus*, the raspberry, is a native of most parts of Europe, as well as of Mount Ida, in Crete, whence it derives its specific name. The fruit consists

of numerous carpels, the mesocarps of which become succulent, forming drupeolæ. There are many cultivated varieties of this species, differing in colour, from red to a yellowish white; as well as in fragrancy and flavor. Raspberries are agreeable to most palates; and, not being prone to run into the acetous fermentation are wholesome, and may be eaten even by gouty persons, and are esteemed beneficial in cases of sand and gravel.

(3042.) The dewberry is the fruit of *R. cæsius*, the cloudberry of *R. Chamæmorus*, the roebuckberry of *R. saxatilis*, the blackberry of *R. fruticosus*, and various other species. The fruit of these plants, although not here much valued, is more or less esteemed in other countries, according to their destitution of choicer kinds: and towards the arctic zone, the flavour of the berries is said to be finer than in the temperate regions. The fruit of *R. arcticus* is delicious; but, although growing wild on the Scotch alps, it will not bear translation to the plains, for the fruit degenerates in the lowlands, and the plant in general dies, or becomes barren, under garden culture.

(3043.) The cloudberry, bruise dand eaten with rein-deer's milk, is a favorite Lapland dish. The Laplanders call it 'latoch,' and make a sapid jelly by boiling it with fish. The Swedes, who are also fond of this fruit, call it 'hiorton;' and Dr. Clarke says, it "is sent in immense quantities from all the north of the Gulph of Bothnia to Stockholm, where it is used for sauces, and for making vinegar." The cloudberry is considered in the North as a valuable febrifuge; and the amiable traveller just quoted mentions with gratitude the benefit he received, when labouring with a violent fever, from eating freely of the fruit, which, under Providence, was the means of restoring him to health. Linneus, in like manner, commemorates the services rendered to him in periods of great privation, during his Lapland journey, by the *R. arcticus*, which he calls a 'beneficent plant;' and says, "he should be ungrateful did he not give a full description of it, since the vinous nectar of its berries frequently recruited his spirits, when almost prostrate with hunger and fatigue."

These several berries, as well as the raspberry and strawberry, have, when just ripe, a most delightfully aromatic taste and smell, which, however, is soon dissipated. When overripe, they become nauseous from speedy decomposition; and if gathered too early, their flavour is coarse and astringent. Hence, much care is necessary in the gathering, for a few immature or decomposing berries will spoil a large quantity, either when made into tarts, or preserved with sugar, in both which forms, when good, they are excellent.

(3044.) Linneus tells us, that in Norland the people make syrups, jellies, and wine, from the berries of *R. arcticus*, not only for their own use, but to send as presents to their friends at Stockholm, esteeming them dainties of the choicest kind, far superior to the *R. Chamæmorus*.

The Russians, also ferment the fruit of *R. saxatilis* with honey, and procure a powerful spirit by distillation. The leaves of *R. arcticus* have been employed as a substitute for tea; and the roots of *R. villosus*, which are astringent, are considered serviceable in the bowel complaints of infants. The long tough shoots of the brambles, especially those of *R. fruticosus*, are used by thatchers, straw-hive, and mat-makers, to bind their other materials together. *R. apetalus* is remarkable for the abortion of its corolla; and *R. biflorus* for its destitution of prickles.

(3045.) Of the *Fragaria*, or strawberry, there are about 12 or 13 known species, of several of which there are numerous cultivated varieties.

F. vesca affords the scarlet, and the several sorts of white and red wood strawberries. *F. collina*, the pine, or rather alpine strawberries. *F. elatior*, the different sorts of hautbois, some of which are the most delicious fruit of the whole. The hautbois is remarkable for the flowers becoming separated and diœcious, the stamens being abortive on one plant and the pistils on another; and hence, as the part here valued as fruit is not the seed or pericarp, but the torus, the sterile individuals should be extirpated in garden-culture. The hautbois is a native of the high woods of Bohemia, whence its name.

(3046.) *F. Virginiana, grandiflora*, and *Chilensis*, afford numerous varieties also, more or less celebrated for their size or flavour, such as the American scarlet, Bishop's seedling, the early globe, the Garnstone scarlet, the Hudson's Bay, the melon, and the roseberry, of the first species; Keen's seedling, and imperial, the black prince, the bullock's blood, &c. of the second; and the black and blush Chili, the Canterbury, and Wilmot's superb, of the last-named species.

(3047.) *F. Virginiana* (the American scarlet), *F. grandiflora* (the oriental pine), and *F. Chilensis* (the Chili strawberry), are by some authorities considered to be only varieties of one and the same species, just as *F. elatior* and *collina*, our hautbois and alpine strawberries, are thought by many persons to be only varieties of *F. vesca*. And it is a curious circumstance, that as the *F. vesca* and *F. collina* afford our European scarlet and pine, or alpine strawberries, so likewise the exotic scarlets and pines are the frnits of *F. Virginiana* and *grandiflora*; which have now become so common in our gardens, as almost to have superseded the older kinds. The English name, strawberry, is believed by some persons to have reference to an old custom lately reintroduced, of putting straw underneath the plant to prevent the fruit being soiled; but it is more probably a corruption of stray-berry, from the trailing or wandering of its runners, which travel to great distances from the parent plants, and establish colonies all around. The word is written straberry by John Lydgate, who died in 1483, in his poem called "London Lyckpenny."

(3048.) Strawberries have long been cultivated, to a great extent in the neighbourhood of London, and even in what is now the heart of the metropolis. The fact has been mentioned by Hollinshed, and dramatized by Shakspeare, that Glo'ster, when contemplating the death of Hastings, asked the bishop of Ely for strawberries:

> "My lord of Ely, when I was last in Holborn,
> I saw good strawberries in your garden there."

In the present day, Twickenham and Isleworth send the chief supplies to the London markets. And "one of the most remarkable instances of the power of the human body to endure great and continued fatigue, is shewn by the strawberry women, who, during the season, carry a heavy basket twice daily from Twickenham to Covent Garden, walking upwards of forty miles. Fatigue like this would soon destroy a horse, but these Cambro-Britons, who come purposely from the Welsh collieries, endure the labour for weeks, without injury or complaint." (*Fruits Lib.* E. K.)

(3049.) *F. monophylla*, sometimes said to be a variety of *F. vesca*, is remarkable for the reduction of the leaflets, so that only a single foliole is found upon each footstalk.

(3050.) Potentilla is a large genus of very ornamental plants, some of which were once supposed to afford very potential medicines, and hence the generic name. None of them are deleterious, but they are not possessed of any very active properties. They are more or less astringent and bitter; and the root of *Potentilla reptans*, which appears to have been the officinal plant of the ancients, is still reputed a febrifuge, although in far less esteem than before other more potent drugs were known. Economical advantage has also been taken of the astringency of these plants, and they have been employed in the process of tanning.

The leaves of *P. anserina* form a favorite food with geese; and they are occasionally used as potherbs. Its roots also are relished both by hogs and men; they have something the flavour of a parsnip, but are small. They are nevertheless frequently eaten by the common people in Scotland, both roasted and boiled. In the islands of Tiray and Col they answer in some measure the purposes of bread, and they have been known to support the inhabitants for months together, during a scarcity of provisions.

The leaves of *P. fruticosa* and *rupestris* are employed in Siberia as a substitute for tea.

(3051.) *Potentilla Fragariastrum*, once considered a species of Fragaria, shews the close affinity of this genus with the last; and *Tormentilla*, often still blended with it, has scarcely any constant differential characters, flowers with 4 and 5 petals being occasionally on the same plant. The *Tormentils* are much more astringent than the *Potentillæ;* and, from their moderating the discharges and relieving the *tormina* in dysentery, they have received their generic name. *T. officinalis* is still retained in our lists of medicines, and is a valuable remedy for diarrhœa. The rootstakes are so very astringent that they are used in the Hebrides and Orkneys to tan leather, for which purpose they are said to be superior even to oak-bark; 1 lb. being equal to 7 lbs. of ordinary tan, according to a report published in the "Transactions of the Natural History Society of Berlin." In Lapland the roots are used for dying skins of a red colour. Mr. Young informs us that swine are fed on them in Killarney; and they are also thought to be serviceable in some of the diseases to which sheep are subject.

(3052.) The Cowberry or *Comarum* is, like most of the other plants in this subtype, sufficiently astringent to be used in tanning. The roots will also dye wool of a yellow colour.

(3053.) The different species of *Avens* are still valued in our provinces for imparting a pleasant flavour, and giving a relish to various articles of food; and hence they have received their generic name *Geum*. The city aven, when gathered in the spring and put into ale, not only improves the taste, but prevents it turning sour; and the roots of this species, as well as of the water avens, (*G. rivale*,) are esteemed as stomachics, and said to be useful medicines in cases of diarrhœa; the Canadians also administer them in agues.

(3054.) Agrimony has long been celebrated as a vermifuge; and one species (*A. Eupatoria*,) which Pliny tells us bears the name of Eupator, king of Pontus, who took it as a medicine, enters into the composition of many of the British

herb teas. It has also been used in decoction as an astringent gargle and lotion, as well as taken internally in fevers. Like its associates, it has been employed in dressing leather, and it will dye wool of a nankeen colour.

(3055.) *Brayera*, a genus allied to the preceding, is the *Cotz* or *Cabotz* of the Abyssinians; and Dr. Brayer, after whom it has been named, affirms it to be a most powerful anthelmintic. He says, "that two or three doses of it in infusion are sufficient to cure the most obstinate case of tænia." It is much esteemed in Constantinople, being imported into that city from Abyssinia. The infusion is recommended to be made by steeping 4 or 5 drachms of the flowers and seeds in 12 ounces of water.

(3056.) *Rosidæ.* Numerous as the roses are, upwards of 200 species being known, besides three-fold that number of varieties, they are all so similar in structure that it has been found expedient to include the whole in a single genus. Various attempts have been made to subdivide the roses generically; but even the *Lowea* of Lindley, although differing in the organs of vegetation from the other species, cannot be regarded as more than a subgenus; and hence Rosa stands alone in this subtype.

(3057.) The species which affords the chief garden varieties is *R. spinosissima*, the Burnet Rose, of which there are about 200 double and single sorts; *R. Damascena*, the damascus or damask rose, of which there are upwards of 50 sorts; *R. centifolia*, the hundred-leaf or cabbage Rose, of which there are nearly 80 sorts, besides the very distinct group of moss-roses, (*R. muscosæ*,) about 7 in number, which are varieties of this species; *R. Gallica*, the French rose, of which there are nearly 200 sorts; *R. alba*, the white rose, of which there are about 30 sorts; *R. rubiginosa*, the sweetbriar or eglantine, of which there are 11 or 12 varieties, and several subvarieties; *R. canina*, the dog-rose, of which there are 17 varieties; *R. Indica* and *semperflorens*, the monthly and Chinese roses, of which there are about 40 sorts. *R. systyla, arvensis, sempervirens, multiflora, moschata, Banksiæ*, and others, contribute to ornament our gardens and enrich our rosaries; and, besides such as are traceable to different species, there are upwards of 700 sorts recorded in our catalogues, (vid. Don's Dictionary,) the specific connexions of which cannot with certainty be traced.

(3058.) *R. Banksiæ* is remarkable for its want of prickles.

It would be as foolish to attempt to *praise* as to *paint* the rose. The rose requires no commendation here. Perhaps from such a notion it might be, that this flower was considered the symbol of silence; for we are told that the goddess *Isis*, and her son *Harpocrates*, were crowned with chaplets of roses.

(3059.) Roses are intolerant of smoke, and hence they never thrive, either in or very near large towns. *R. canina*, or the dog-rose, is grown for the sake of the succulent calyx tube that invests its akenia, from which the conserve of hips, a pleasant pectoral medicine, is made. The petals of *R. Gallica* and *R. Damascena* are collected for the purpose of making infusions and a confection of rose petals, both much used in medicine. Rose-water, and the attar of roses, are both procured from *R. centifolia*. About 6 lbs. of rose-leaves will make a gallon of good rose-water; but from 200 to 250 lbs. weight are required to yield one ounce of the attar. Hence surprise ceases at its being such a costly scent; and great inducements are held out for its adulteration.

(3060.) The petals of *R. Gallica* and *Damascena* are much less fragrant when

fresh than those of *R. centifolia*, but the latter lose their scent, while the former become more odorous, by drying. They are likewise more astringent, and hence their officinal employment.

(3061.) Astringency and fragrance are the predominant qualities of the roses, varying however in the different species, and in different parts of the plants. The former property is most fully developed in a morbid excrescence, called *Bedeguar*, and which is produced by the puncture of an insect, named *Cynips* Rosæ. This diseased growth is very common on the sweetbriars, and was once much esteemed as a styptic, and used both internally and externally to check hæmorrhages.

(3062.) One species of rose (*R. Lowea*), is remarkable for having simple leaves, destitute of stipules; and hence Lindley has proposed to separate it as a genus from the Rosæ, and to call it *Lowea*. It is however not advisable to regard it as more than a subgenus, for its organs of fructification are, in all respects, identical with the roses. A figure, and the best account that has appeared of this curious plant, will be found in the "Botanical Register," (1261,) from which the following are extracts.

"*Lowea berberifolia. Folia simplicia exstipulata. Aculei sæpius compositi.* The two most important topics connected with this rare plant, which is a native exclusively of a few districts in the north of Persia, and of the desart of Songari, in Chinese Tartary, relate firstly to its genus, and secondly to its cultivation. In the latter respect, no more appears to be known now than was known upon its first introduction. It resists cultivation in a remarkable manner, submitting permanently neither to budding nor grafting, nor laying, nor striking from cutting, nor, in short, to any of those operations, one or other of which succeed with other plants. Drought does not suit it, it does not thrive in wet; heat has no beneficial effect, cold no prejudicial influence; care does not improve it, neglect does not injure it. Of all the numerous seedlings that were raised by the Horticultural Society from seeds sent home by Sir Henry Willock, and distributed, scarcely a plant remains alive. Two are still growing in a peat-border in the Chiswick-garden, but they are languishing and unhealthy; and we confess, that observation of them in a living state, for nearly four years, has not suggested a single method of improving the cultivation of the species. As to its genus, it is well known that, since the days of Linneus, the characters of the genera of flowering plants have been exclusively taken from the organs of fructification, while those of vegetation have been rigorously excluded. This has arisen from the former having been supposed, in all cases, more constant in their modifications, and less subject to variation than the latter. No other reason can be assigned for the value thus exclusively ascribed to the organs of fructification. It is, however, time that botanists should disembarrass themselves of this ancient prejudice, and admit publicly, that by which they are constantly influenced in private—that important modifications of the organs of vegetation are sufficient to divide into genera, species which do not essentially differ in the organs of fructification.

"Of this the Indian Cypripediums are one instance, the genus Negundium is another, and the subject of this article is a third. The structure of its flower is, in every part, that of a rose; but its foliage is not even that of a Rosaceous plant, there being no trace of stipulæ. The simple leaves are not analogous to the terminal pinna of a rose-leaf, for there is no trace of the articulation upon their

petiole, which is required to indicate a reduction of a compound leaf, as we find in Berberis; neither can they be considered confluent stipulæ, for their venation is not what would be found under such circumstances, but precisely that of an ordinary leaf."

(3063.) *Neuridæ.* Like *Rosa*, *Neurada* is a solitary genus in the subtype to which it gives its name; but, unlike *Rosa*, this genus contains but a single species. If really belonging to this group, *Neurada*, by its carpels becoming connate and forming a 10-celled capsule, may be regarded as a deviation from the normal structure of the group, analogous to that which occurs in *Spiræa sorbifolia* of the following type; and both these plants having capsular fruits, they may be esteemed the connecting links between the *Rosaceæ* and *Spiræaceæ*.

(3064.) *Neurada* is a native of Numidia, Egypt, and Arabia, growing in the barren sandy desarts of those countries; and, like other plants similarly situated, its seeds germinate within the capsule, which shields them in some measure from drought, and perhaps affords them in their infantile state a small supply of nourishment.

(3065.) Spiræaceæ. *Spiræa*, *Quillaja*, and their immediate allies, are frequently included in one type with the *Rosaceæ*, from which, however, they appear to be sufficiently distinct.

They are trees or shrubs, rarely herbaceous plants, with alternate leaves, in general simple, but sometimes imparipinnate or pinnato-sected, with lateral stipules, which are often caducous, and sometimes obsolete.

The inflorescence is terminal, and the flowers disposed in corymbiform panicles or racemes; seldom solitary: united, or by abortion separate. The calyx is 5-cleft, not girded by bracteæ, and either imbricate or valvate in æstivation; the tube often adhering to the stalk of the germen; the limb either persistent or marcescent; and the fifth lobe axial. The petals are 5, (rarely 6,) free, equal, perigynous, and alternate with the lobes of the calyx. The stamens are many, perigynous, and curved inwards during æstivation. The filaments are free, the anthers innate, 2-celled, and dehiscing lengthwise. The germen is free, formed of several (generally 5) carpels, each containing many ovules; the styles are distinct and terminal, and the stigmata simple.

The fruit consists of several follicles, in general free, rarely connate, and arranged in a whorl round the ideal axis of the fructification. The seeds are 2-4, or many, rarely solitary by abortion, and in general exalbuminous. The embryo is straight, erect, (rarely inverted, as in *Spiræa*,) the radicle pointed towards the hilum, the plumula inconspicuous, and the cotyledons flat, and foliaceous during germination.

(3066.) Hence, differentially considered, the *Spiræaceæ* are follicular *Rosinæ*, with non-bracteate calyces, polypetalous or apetalous flowers, terminal styles, and pluriovulate carpels.

(3067.) The *Spiræaceæ*, which have long been noticeable for containing several aberrant genera, are now distributed into two subtypes: the *Spiræidæ* or normal *Spiræaceæ*, and the *Quillajidæ* or deviating ones.

(3068.) The *Spiræidæ* are herbaceous or shrubby *Spiræaceæ*, with an imbricate æstivation of the calyx and discrete follicles, and mostly erect embryos, and flat thickish cotyledons.

(3069.) The *Quillajidæ* are arboreous *Spiræaceæ*, with a valvate æstivation of

the calyx, follicles connate at the base, and erect embryos with foliaceous cotyledons.

(3070.) *Spiræidæ.* The meadow-sweets were formerly very favorite garland flowers, and hence their generic name *Spiræa; Spireon* (from *σπειρα*, a cord), being formerly a common term for such plants as were fit for twisting in wreaths and coronals. They are very ornamental herbs; and, being both bitter and astringent, the root of *S. filipendula* and *ulmaria* have been recommended as tonics; and from the flowers of the latter a fragrant water may be procured by distillation, which is an agreeable aromatic beverage, and the leaves of *S. lævigata* might serve as a substitute for tea.

(3071.) *Spiræa monogyna* is remarkable for having a solitary carpel; thus anticipating the structure of the sanguisorbaceæ; in *S. Sorbifolia* (or *schizonotus*), the carpels cohere and form a capsular fruit: and in several species the stipules are absent.

(3072.) *Gillenia trifoliata,* and *stipulacea,* are possessed of emetic properties, and the roots are used in Canada and Florida instead of ipecacuanha. The leaves and branches are said to be astringent and tonic.

(3073.) *Neillia,* associated with the spiræas by De Candolle, and referred to the *Homaliaceæ* by Don, has, like *Schizonotus,* a capsular fruit; but is still more aberrant by the copious fleshy albumen of its seeds.

(3074.) *Quillajidæ.* The *Quillai* or *Cullay* of Chili, whence the botanical term *Quillaja,* is the soap-bark of some parts of South America, so called on account of the uses to which it is applied by the Chilian washerwomen. It is said to make an excellent lather, and effectually to remove grease from woollen and silken goods; and hence, by Ruiz, it was named *Smegmadermos.*

(3075.) *Kageneckia oblonga* is the Lyday of Chili, where its timber is used in domestic architecture. Its leaves, as well as those of *K. lanceolata,* are bitter, and are employed by the Chilians as a remedy for ague.

(3076.) *Lindleya* and *Vauquelinia* are the only other genera included in this subtype, and each consists of but a single species: neither of which have hitherto been applied to any useful purpose.

(3077.) Sanguisorbaceæ. *Alchemilla, Sanguisorba, Poterium,* and their allies, associated to form this type, are herbaceous or suffruticose plants, occasionally spiny, with alternate stipulate leaves, either simple, lobed, or compound.

The inflorescence is terminal or axillary, and usually in *glomeruli* or tufts. The flowers small, and often separate from abortion. The calyx bracteate, with an indurated tube lined with the disk, and a 3, 4 or 5-lobed limb. The petals are abortive, the stamina definite, perigynous, alternate with the lobes of the calyx, and sometimes fewer in number than its lobes. The filaments are free, the anthers 2-celled, innate, and bursting longitudinally, or 1-celled with a transverse dehiscence. The germen consists of a solitary carpel, the style is exserted either from the base or the apex, the ovule is solitary, attached to the part whence the style proceeds, and the stigmata are either simple or compound.

The fruit is a solitary simple nut or akenium, enclosed within the persistent and often indurated tube of the calyx. The seed is solitary, pendent or ascending, and exalbuminous. The embryo is straight, the radicle superior, and the cotyledons large and plano-convex.

(3078.) Hence, differentially considered, the *Sanguisorbaceæ* are apetalous *Rosinæ*, with a persistent indurated calyx, enclosing a solitary dry carpel, and in general suspended ovula.

(3079.) Of *Sanguisorba* (the Burnet), there are nine known species. These are all astringent plants; and from the use of one, *S. officinalis*, as a styptic, they have received their generic name. The common Burnet forms a useful fodder for cattle, and once was cultivated in chalky districts to a very considerable extent, but it has been in a great measure superseded by sainfoin and the other artificial grasses. On the Continent, and occasionally in this country, the young leaves of Burnet are cut as salads: and it is used to form one of the ingredients of the favorite *Cool tankard*. The several species of *Poterium* scarcely differ, except by the diclinious flowers, from the *Sanguisorbæ*; and *P. sanguisorba* is indifferently cultivated for *Sanguisorba officinalis*. Some say that this is the real toper's plant, and that hence its name *Poterium*, from the custom of infusing it in various liquors. Its roots are eaten by the common people in Siberia.

Margyricarpus, like the rest of its associates, is tonic and astringent, and in Brazil an infusion of the plant is used in cases of hæmorrhage.

(3080.) The *Alchemillæ* have long been celebrated tonics, but it is to be feared they have been prized beyond their deserts. A. vulgaris was called *Alkemelych* by the Arabian physicians; and Hoffman and others affirm that it has the power of restoring feminine beauty, however faded, to its earliest freshness.

(3081.) *Acæna* and *Sanguisorba* have been by some supposed to have petals, and the bracteæ mistaken for a calyx; but this view has long since been proved to be erroneous.

The *Cliffortiæ* are remarkable for the variableness of their leaves, and for the adhesion of their stipules to the shortened petioles.

(3082.) *Cephalotus*, one of the pitcher-plants, has been usually placed in this type; but, since the examination of its fruit, it has been referred by Dr. Brown to the neighbourhood of *Crassulidæ*.

MYRTINÆ.

(3083.) Plants agreeing with the myrtle (*Myrtus*), in general characters, are associated to form this section, which, from the abovenamed normal genus, is called Myrtinæ.

(3084.) The *Myrtinæ* are perigynous *Rosales* or *Myrtosæ*, with simple exstipulate leaves, sepals imbricate (rarely valvate) in æstivation, regular united flowers, usually concrete carpella, and exalbuminous, often pseudomonocotyledonous seeds.

(3085.) This section includes several types or natural families of associated genera. Of these five, named after *Punica* (the pomegranate), *Myrtus* (the myrtle), *Gustavia*, *Memecylon*, and *Melastoma*, are of primary importance: other five there are, some of which have been occasionally admitted as distinct orders, but they seem to be rather subtypes or sections of the preceding.

(3086.) PUNICACEÆ. *Punica* (the pomegranate), *Calycanthus* (the American allspice), and *Chimonanthus* (the winter spice), which form together this small type, are shrubs or trees, never herbaceous plants, with opposite subtetragonal branches, opposite, rarely alternate, exstipulate, impunctate, simple leaves; the petioles are short, the laminæ narrow at the base, and the margins entire.

A. *Myrtus* or *Eugenia Pimenta*. Branch shewing opposite exstipulate leaves, the costulæ of which ought to unite and form an intromarginal line. (*a*) Flower separated and opened, to shew the perigynous stamens. (*b*) A cluster of fruit. (*c*) A pericarp separated. (*d*) Section of ditto. (*e*) Seeds.

B. *Melastoma theæzans*. Branch shewing opposite exstipulate tricostate leaves and flowers. (*a*) A flower separated. (*b*) Vertical section of the calyx, to shew the perigynous exsertion of the petals and stamens, with their 2-celled anthers, the disk adherent to the calyx, and the ovary free. (*c*) The fruit entire. (*d*) Transverse section. (*e*) The seed and the embryo.

C. *Caryophyllus aromaticus*. Branch to shew opposite exstipulate leaves and inflorescence. (*a*) A flower separated and the stamens removed, to shew the perigynous disk and petals. (*b*) Section of the flower, to shew the inferior germen.

The inflorescence is terminal or axillary, the flowers in general solitary, subsessile, large, and monoclinious.

The calyx is tubular, coloured, with an urn- or top-shaped, subcarneous tube, and a marcescent divided limb, the lobes being sometimes definite, at others indefinite, and arranged in many series. The torus is expanded into a fleshy plate, lining the tube of the calyx, and extending to its faux. The petals are equal, alternate with the lobes of the calyx, and sometimes indistinguishable from the sepals,

hence in one subtype (*Calycanthidæ*) the corolla is often said to be absent. The stamens are perigynous, and subindefinite; the filaments are free, and the anthers 2-celled and dehiscing by chinks. The carpels are numerous, and attached either to the torus or the tube of the calyx, 2-ovuled, and their styles, equal in number to the carpels, are either free or connate.

The fruit is either a cynarhodon or balausta, *i.e.* it consists of the numerous carpels enclosed within the fleshy tube of the calyx, and either free and monospermous, or concrete; forming a many-celled and many-seeded spurious berry. The seeds are exalbuminous, the embryo is straight, and cotyledons spirally convolute.

(3087.) Hence, differentially considered, the *Punicaceæ* are fruticose *Myrtinæ*, with opposite exstipulate leaves, an urceolate persistent calyx, and the fruit either a cynarhodon or balaust.

(3088.) Few as are the genera included in this type, they are necessarily distinguished into two subtypes: *Calycanthus* is the normal genus of the one, and the other contains *Punica* only.

(3089.) The *Calycanthidæ* differ from the *Granatidæ* by having multiaxial stems, unarmed branches, impunctate scabrous leaves, imbricate sepals, adnate extrorse anthers (the inner series of stamens being sterile), and free monospermous carpels enclosed within the succulent tube of the calyx, *i.e.* the fruit is a cynarhodon.

(3090.) While in the *Granatidæ* the stem is uni-axial, the branches spinescent, the leaves smooth and subpunctate, the sepals valvate, the anthers innate and introrse, and the included carpels connate, forming a balaust.

(3091.) *Calycanthidæ*. *Calycanthus* and *Chimonanthus* form the transition from the Rosinæ to the present section, the indeterminate corolla, or, according to some authorities, the apetalous flowers of *Calycanthus*, associate with the apetalous Sanguisorbaceæ, and the akeniaceous fruit constituting a cynarhodon, establish the affinity with the whole of the *Rosaceæ*, and especially with *Rosa*: but the Punicaceæ differ from all the Rosinæ, except Chamæmeles, in the convolute cotyledons of the embryo. The wood of the Calycanthidæ is also very singular in its structure, for, besides the central pith or axis, there are found within the stem four other secondary piths or axes of growth near the bark, so that, as Lindley observes, they seem to combine the exogenous and endogenous structures.

(3092.) *Calycanthus Floridus*, the Carolina allspice, is a very fragrant plant; its flowers, which have a chocolate or dark purple hue, smell something like quinces, and its wood and roots have an odour resembling camphor. The other species are equally aromatic, and hence they all are desirable garden shrubs.

(3093.) *Chimonanthus*, the winter spice, has so been called (from *χειμων* and *ανθος*) on account of its season of blossoming being from December to February. The perianth in this flower is physiologically interesting, as the outer parts resemble bracteæ, the inner petals, and the intermediate ordinary sepals, thus shewing analogically the presence of a corolla in the *calycanthi*, notwithstanding its being obscured by the uniform colour of the petals and sepals. There are two varieties of *Chimonanthus fragrans*, both of which have sweet-scented flowers, but the wood is inodorous.

(3094.) *Granatidæ.* Much difference of opinion exists as to whether the pomegranate should be more than generically distinguished from *Myrtus*, and the other *Myrtaceæ*. It was first segregated by D. Don; and, notwithstanding some of his views regarding the structure of the fruit appear to be untenable, sufficient differences remain to justify its separation from the true *Myrtaceæ*, although it is still retained amongst the *Myrtinæ*.

(3095.) The pomegranate, so called from its fruit having been likened to an apple full of seeds, has received its generic name, *Punica*, either from the scarlet colour of its flowers, or in reference to its Punic habitat; the plant being a native of the northern parts of Africa, and especially abundant on the Carthaginian shores. The fruit, which is the *Malum Punicum* of the ancients, has been called *grenade* by the French, on account of its fancied resemblance to that implement of war. The pulp that invests the seeds is acid and refreshing; but, although much esteemed in Turkey and the East, the fruit is one of secondary quality, and very inferior to the orange. The expressed juice is made into pleasant syrups and sherbets, and, when fermented, a sort of wine, called the wine of Palladius, is produced. The seeds are oleaginous, and, as they are abundant, oil might perhaps be profitably extracted from them. The rind of the fruit (or *Malicorium*) is exceedingly astringent, and is used medicinally in decoction to form gargles, lotions, &c. and administered internally in diarrhœa and other morbid fluxes. Its efficacy has also been vaunted in the cure of tape-worm. The undeveloped buds (or *balaustra*) possess properties similar to those of the *Malicorium*, and are used for similar purposes.

(3096.) The *Punicæ* are still further interesting, from their leaves, although really without intromarginal veins, and impunctate, shewing, by the occasional union of the venæ arcuatæ, and a few scattered dots, their approach to the true *Myrtaceæ*.

(3097.) Myrtaceæ. The myrtles and their typical allies are trees or shrubs, with, often, angled branches, and simple exstipulate leaves, mostly opposite, but rarely alternate or in whorls, as in some Melaleucæ. The costulæ are arcuate, and form by their union intromarginal ribs or veins, and the expansion, for the most part coriaceous, is furnished with numerous dot-like receptacles, containing aromatic essential oils, upon which the fragrance of the foliage of these plants depends. The inflorescence is both terminal and axillary, variable in its form, generally aggregate, the blossoms being seldom solitary, but collected in spikes or corymbiform panicles, and furnished with two bracteæ at the base of each flower.

The flowers are united and regular, white or red, and occasionally yellow, but never blue. The tube of the calyx is adherent to the germen, the limb 4-5 or rarely 6-cleft, either persistent or deciduous, and imbricate in æstivation; sometimes the lobes are united, continue closed, and are circumscissile at the base, falling off like a veil or calyptra on the expansion of the flower. The petals (rarely wanting, when present) are equal in number to the lobes of the calyx, and alternate with them. They are quincuncial in æstivation, and sometimes, like the sepals, coalesce and form a deciduous operculum. The stamina, like the petals, are perigynous, and are, when not indefinite, two or three times their number, and often arranged in several series. The filaments are distinct or connate, and curved inward before flowering. The anthers are small, ovate, 2-celled (rarely 1-celled), and with a longitudinal dehiscence. The germen is inferior, 1-6-celled, multiovulate, and

with central trophosperms. The style is single, and the stigma in general simple and entire, seldom divided.

The fruit is various, either dry or fleshy, capsular, baccate, or drupaceous, many-celled and many-seeded, sometimes (by abortion) 1-celled and 1-seeded. The seeds are in general inverted, seldom erect, variable in form, exalbuminous and exarillate. The embryo is either straight or curved, with its plumula inconspicuous, its radicle turned towards the hilum, and its cotyledons in general flat and distinct, but sometimes conferruminate with the radicle, and forming one solid mass.

(3098.) Hence, differentially considered, the *Myrtaceæ* are aromatic *Myrtinæ* with many stamens, small anthers, and opposite punctate leaves, having intromarginal costulæ.

(3099.) The *Myrtaceous* genera, after excluding those aberrant ones that form the following type, *Gustaviaceæ*, still appear to be advantageously distributed into three subtypes, which, from *Chamælaucium*, *Leptospermum*, and *Myrtus*, are called the *Chamælaucidæ*, *Leptospermidæ*, and *Myrtidæ*.

(3100.) The subtype *Chamælaucidæ* contains those deviating *Myrtaceæ* in which the stamens are uniseriate; the sterile and fertile ones being mixed, the fruit dry and 1-celled, and the ovula erect.

(3101.) The *Leptospermidæ* are *Myrtaceæ*, with stamens either free or polyadelphous, and the fruit dry and plurilocular.

(3102.) The *Myrtidæ* are genuine *Myrtaceæ*, with free stamens, and a fleshy, many-celled fruit.

(3103.) *Chamælaucidæ.* *Calythrix*, *Darwinia*, and their subtypical allies, are heath-like plants, and all natives of New Holland. The name, *Calythrix*, is almost too similar in sound to *Calothrix*, one of the Confervæ, for both to be admitted in botanical nomenclature. The *Darwiniæ* are curious plants, more curious than useful; their flowers are remarkable for being apetalous. *Pileanthus* is also interesting from its buds being enclosed in a 1-leaved involucrum, which, before their evolution, is closed on all sides, but at length becomes circumcised, and falls off like a calyptra, leaving a cup-shaped base.

(3104.) *Leptospermidæ.* *Melaleuca*, *Astarte*, and five other genera, differ from the rest of the *Leptospermidæ* by having polyadelphous stamens; hence they have been associated in a district called *Melaleuceæ*, while those with free stamina are termed *Leptospermeæ*.

(3105.) *Melaleuceæ.* *Melaleuca* is the most important genus in this district; the others are chiefly prized as handsome ornamental shrubs.

(3106.) *Melaleuca Leucadendron* is the *Kai-pouti* or *Cuiau-pouti* of the Hindus; and from the leaves of this tree, when distilled, there is procured the well known essential oil called *cajeput*. This oil is a powerful stimulant and sudorific; it is also esteemed as an antispasmodic; and hence has been long recommended both as an internal medicine and as an embrocation, to relieve the pains of chronic rheumatism. An opinion prevailed, on the arrival of Indian cholera in Europe, that cajeput oil was almost a specific in the disease. A run, like a run for gold in a mercantile panic, took place for cajeput oil on all the druggists and drug-merchants in London; its price became exorbitantly advanced, and in an inverse ratio its quality diminished; for druggists can *manufacture* medicine much more readily and safely than bankers can coin gold. Cajeput is probably not more

efficient in the cure of cholera than any other aromatic oil; but of this no satisfactory proof can be drawn from the failure of its substitute here, which can scarcely be called an adulteration, as much of it was probably unconscious of the presence even of a drop of the veritable drug.

Cajeput oil has the property of dissolving caoutchouc: a decoction of the leaves is used in China as a tonic, and the bark of the tree is said to be serviceable in caulking boats and roofing houses.

(3107.) The leaves of *M. genistifolia* are employed in New Holland as a substitute for tea.

(3108.) *Eudesmia tetragona*, the only species in the genus, is remarkable for the petals cohering by their edges and becoming circumcised at their bases, thus forming an operculum; while the calyx, which is operculate in Eucalyptus, has its sepals here in their regular condition.

(3109.) *Leptospermeæ*. The *Eucalypti* have received their generic name from the perianth having its pieces concrete, and from the circumscissile separation of the limb from the tube, forming an operculum or calyptra. The petals are here said to be absent, but as in some genera the operculum, according to the observations of Dr. Brown, is double, both calyx and corolla are not improbably blended together.

(3110.) The *Eucalypti* abound in an aromatic essential oil which in its qualities is said to resemble cajeput. *E. resinifera* yields an astringent gum-resin resembling kino, for which it has been substituted in medicine, and it is affirmed to be equally efficacious as an astringent. Other species abound in tanning; and a manufactory has been established in Van Diemen's Land for the purpose of extracting the active principles. Some of the extract, imported into England, is said to be twice as powerful as oak-bark in the conversion of skins into leather.

(3111.) The heart-wood of *Metrosideros*, as the name imports, is very hard, almost as hard as iron. The timber of *M. vera* is hence called iron-wood, and the Chinese make anchors and rudders of it. The bark is said to be astringent, and to be useful in cases of diarrhœa, and wherever styptics are indicated. *M.* (or *Angophora*) *costata* is reported to exude a gum-resin when its trunk is wounded, which in New Holland is called gum-arabic.

(3112.) *Leptospermum scoparium* is the "tea-plant" of Captain Cook, which proved so beneficial to the crews of that adventurous circumnavigator's ships, when the scurvy prevailed amongst them, during his lengthened voyages. The leaves and twig-tops have an agreeable bitter taste and pleasant smell when fresh, both which, however, are lost by drying. The infusion when very strong proves emetic, in the same manner as too strong green tea, but, when made of a moderate strength, it is wholesome and refreshing. The leaves of this plant have been also mixed with spruce-tops, in the manufacture of spruce-beer, to render it more palatable.

(3113.) *Myrtidæ*. The Myrtle, the Allspice, and the Clove, with the Guavas, Rose-apples, and other highly aromatic or agreeable fruits, are included in this subtype, none of which are known to be possessed of any deleterious properties.

(3114.) *Sonneratia* is a deviating genus, for its leaves, although opposite, are

impunctate and nearly veinless; and in one species (*S. apetala*) the corolla is abortive.

(3115.) The *Palillo* of Peru is the *Campomanesia linearifolia*: it is cultivated by the Peruvians for the sake of its fruit, which resembles the guava; and an allied species or a variety of the preceding is much esteemed in New Grenada, where it is called *Guyavo di Anselmo.*

(3116.) *Psidium* (ψιδιον), an ancient name of the pomegranate, is now given to the guava, to which it has some resemblance. In the West Indies the guavas are eaten with avidity both by natives and Europeans. They have a fragrant but peculiar odour, and very sapid taste; they are served both raw and made into jellies, and the better sorts are vaunted as delicious. *P. pyriferum* is the common guava, but its flavour is inferior to *P. Guiniense* and *P. Cattleianum.* The fruit of other species is eaten, such as *P. polycarpon* and *pomiferum*; the former is delicate, but the latter too astringent to be agreeable. It is however considered a good stomachic. The fruit of *P. montanum* is small and acid; it has the smell of bitter almonds; and hence it has been called *Almandron*: its wood, which is of a dark colour, and finely curled in the grain, takes a fine polish, and is easily worked, it is hence much esteemed for many ornamental purposes.

(3117.) The clove (*Caryophyllus aromaticus*), is a native of the Moluccas, and of other islands in the Chinese Sea, from which the plants have been transported to several parts of either India, China, Persia, and Arabia; but their profitable culture seems confined to a limited range of climate, as even in some of the larger islands near the Moluccas, and in Cochin-China, the aroma is lessened, and in many places the clove ceases to be a spice; for, although it may be grown, it is tasteless. Cloves have been brought to the European markets for upwards of 2000 years, but it is little more than three centuries since we were in utter ignorance of the countries in which they grow: for, previous to the discovery of the Moluccas by the Portuguese, in 1511, Europe was supplied with this and other Oriental spices from the Levant, the Asiatic merchants conveying them to the ports of the Mediterranean from the interior of that vast continent.

(3118.) It is thought that the ancient Greeks and Romans were unacquainted with the clove, although it has been known in Arabia from immemorial ages. The argument derived from the supposed Greek origin of its name *Caryophyllus*, [from καρυα φυλλον], thus indicating that it is a *leafy nut*, is more ingenious than convincing; for the Arabs call the plant *Qarumfel*, and it is mentioned both by Serapion and Avicenna as the *Carunfel* and *Carumfel bellum*, of which Caryophyllus is a corruption, not more altered than words frequently are on their translation from one language to another. The Dutch, who soon dispossessed the Portuguese of the Moluccas, called this spice *Naghel*, from its nail-like form; the French call it *Clou*, and the Spaniards *Clavo*, whence our clove.

The Dutch pursued a similar policy with regard to the clove as with the nutmeg and other spices, endeavouring to restrict their growth to Amboyna, destroying the trees in the neighbouring islands, and regulating their number by legal enactments; at one time compelling the inhabitants to plant fresh trees as in 1720, to bring up the number in one small island to 500,000, which yielded on an average a million lbs. of cloves per annum; and at another, as in 1769, 1773, and 1775, when, from the previous encouragement, the clove plan-

tations were greatly extended, and the market value of the spice reduced, ordering them to be cut down, so that at one of these fellings upwards of 50,000 trees were destroyed. The natives of Amboyna, as long as the decimations were confined to the plantations, looked on the proceedings of the Dutch with indifference; but they had a custom of planting a clove-tree, which they called a *Tatanamang*, at the birth of each child, whereby a rude register was kept of their respective ages. And when in 1775, besides 50,000 plantation-trees, nearly 25,000 *Tatanamangs* were cut down, a general insurrection took place, which with much difficulty was quelled; and so little did the Dutch enter into the feelings of the people over whom they ruled, that these ebullitions of popular feeling were stigmatized by the writers as a base and wicked spirit of disobedience; and Valentyn even ventures to say, "It would have been better, if instead of extirpating their trees alone, we had at the same time exterminated this revengeful and sanguinary nation." The average annual crop of cloves is, from each tree, 2 or 2½ lbs.; but a fine tree has been known to yield 125 lbs. of this spice in a single season; and as 5000 cloves only weigh one pound, there must have been at least 625,000 flowers upon this single tree.

(3119.) Every part of the clove plant abounds with aromatic oil, but it is most fragrant and plentiful in the unexpanded flower-buds, which are the cloves of commerce.

The clove is a very powerful and stimulating aromatic, and these properties depend upon the essential oil that it contains. This oil is so abundant that it may be expressed from the fresh buds, but is usually procured by distillation. It is one of the very few essential oils that is specifically heavier than water. It is from its value often adulterated, and at one time the fraud was common of extracting part of the oil from the cloves, and then sending them into the market mixed with various quantities of the uninjured spice. Cloves are remarkable for their power of absorbing moisture, and cunning traders put the bulk of spice, when any quantity is ordered, near a vessel of water, and, as they are sold by weight, a very considerable addition is made surreptitiously to the actual quantity of the spice. The clove tree, when growing, absorbs moisture most greedily, both from the soil and atmosphere; even to such an extent, that it is said no herbage is found beneath its shade; such, at any rate, is the physiological explanation of the fact; but superstition and ignorance would give another account.

(3120.) Myrtus having become by modern discoveries a most unwieldy genus, it has been subdivided into several groups, which are named *Jossinia*, *Eugenia*, *Pimenta*, *Myrtus*, *Myrcia*, &c., but their generic distinctions are not universally acknowledged.

The fruit of the *Jossiniæ* is eatable, but not so much esteemed as that of many species of *Eugenia*, some of which, such as *E. Djouat*, *Michellii*, and *Pseudo-psidium*, are said to have an exquisite fragrance and delicious flavour. *E. dysenterica*, *Cheken*, *racemosa*, and *acutangula*, are valuable aromatic astringents, and are serviceable in cases of diarrhœa and dysentery.

(3121.) The *Eugeniæ* are remarkable for having their seed-lobes conferruminate; and to such an extent does the union oftentimes take place, that various species, such as *crassifolia*, *E. Egensis*, *Kunthiana*, *Ludibanda*, *sessilifolia*, and *verruculosa*, are pseudo-monocotyledons.

(3122.) The allspice or pimento, once considered a species of Myrtus, and

subsequently of Eugenia, is by some persons generically distinguished from both, and called *Pimenta vulgaris,* instead of *Myrtus,* or *Eugenia Pimenta.*

The berries, when intended to be used as spice, should be gathered as soon as the flowers have fallen, and not be allowed to ripen, for when mature, they become soft and tasteless.

Pimento berries have a commingled taste of cloves, cinnamon, and nutmegs; and hence their common name of allspice. The oil of pimento is powerfully aromatic and carminative, and may be substituted in medicine for those which are more costly. Some persons think it nearly equal to the oil of cloves.

(3123.) The myrtles (myrti) are distributed into two subgenera, the one called *Leucomyrtus,* contains all the species which have white flowers; and the other named, *Rhodomyrtus,* the remainder that have red ones.

Myrtus communis, the common myrtle, is, like the rest of the genus, aromatic and astringent, and it was once used in medicine. In many parts of Greece, Italy, and Provence, the bark is used for tanning. Myrtle buds and berries were

Myrtus Communis.

eaten as spices by the ancients, and they are still used in Tuscany instead of pepper. The Tuscans also prepare a sort of myrtle-wine, which they call *Myrtidanum.* The distilled water of myrtle-flowers is that very agreeable perfume known in France under the name of '*Eau d'Ange.*'

In Chili, the natives make a very good drink with the expressed juice of the berries of M. Ugni; and on the banks of the Orinoco, a decoction of the root of *M. salutaris* is used as a styptic; as is also that of *M. multiflora,* in Chili and Peru. But, notwithstanding their acknowledged astringent properties, the myrtles are seldom used medicinally, and they are only cultivated in modern times as ornamental plants.

(3124.) *Myrcia,* a surname of Venus, to whom the myrtle as well as the rose were consecrated in mythology, includes numerous species that are closely allied to the *myrti,* and indeed scarcely can be esteemed generically distinct.

M. pimentoides is a fragrant plant, and its leaves, buds, and berries, have something the smell and taste of allspice.

M. acris is the wild clove of Jamaica; its leaves, flowers, and fruit, are all highly

aromatic, and are frequently used as condiments in cookery. The wood of this tree is hard and heavy, and is esteemed for mill-cogs.

(3125.) *Calyptranthes*, like *Eucalyptus*, is remarkable for having the perianth circumcised, so that, although entire before flowering, the limb during the development of the bud becomes separated from the tube, and forms a lateral deciduous operculum. The petals likewise are reduced in number and in size, and sometimes altogether wanting. The flower-buds of *C. aromatica* are highly fragrant, and are used in Brazil as a substitute for cloves. Its bark is also aromatic and bitter, and has been imported into Europe under the name of clove-canella.

(3126.) The Java plum is the fruit of *Calyptranthes*, or *Syzigium Jambolanum;* when ripe it is black and sweet, about the size of a plum, and is much esteemed in Java, the Isle of France, and other parts of the East, where it forms a commercial commodity of considerable importance.

In the Syzigia the operculum is formed as in Eudesmia by the cohesion and circumcision of the petals, and not of the sepals, as in *Calyptranthes* and *Eucalyptus*.

(3127.) The rose-apple, or *Jamsorade*, is the *Schambu* of the Malays, of which name Jambosa is the Latinized transformation. The Jambosæ are cultivated in the East Indies for the sake of their fruit, which is eatable, in all the species, and in some the flavour is excellent. The common *Jamsorade* (J. vulgaris) tastes like a Brussels apricot; and *J. Malaccensis*, which is plentiful in most of the islands of the South Sea, has a fleshy agreeable fruit, almost as fragrant as a rose.

(3128.) The Brazilian *Jaboticabeiros* is also said to be a most delicious fruit; it is brought from the forests to the towns of St. Paul and Tejuco; but it is not at present known to which genus of the *Myrtaceæ* it belongs.

(3129.) GUSTAVIACEÆ. *Barringtonia* and *Lecythis* are the normal genera of two small subtypes, which are included by Jussieu in his *Myrtaceæ;* but the latter is separated by most other writers; and the former, although left along with the *Myrtaceæ* by Don and Lindley, is acknowledged to be a non-conforming group. Hence, these two subtypes, which differ from the *Myrtaceæ* in having alternate impunctate leaves, are here associated to form the proximate type.

(3130.) The *Gustaviaceæ* are trees in general of a large size, with entire simple, alternate, impunctate leaves, (seldom nearly opposite or whorled,) and with mostly serrated edges, and stipulæ none, or very small and caducous; the inflorescence is terminal or axillary, sometimes solitary, but is chiefly racemose or paniculate; and the flowers are united, large, and shewy.

The calyx is adnate to the germen, 2-6 sepaled, with often an urceolate tube and divided limb, the lobes being either valvate or imbricate in æstivation. The petals are from 4-6, sometimes coherent at the base, and imbricate in æstivation; the stamens are numerous, perigynous, or subepigynous, and connected by their filaments. The ovarium is inferiór, 2-6 or many celled; the ovules indefinite, the placenta central, the style single, and the stigma simple.

The fruit is either baccate or dry, and when dehiscent opens transversely; the cells are many, the seeds several and exalbuminous. The albumen is sometimes undivided, and at others exhibits two large fleshy or leafy cotyledons,

occasionally folded on the radicle, which is near the hilum; and the plumula is inconspicuous.

(3131.) Hence, differentially considered, the *Gustaviaceæ* are impunctate *Myrtinæ*, with alternate leaves and intromarginal costulæ.

(3132.) The genera thus associated by their aberrations from the true *Myrtaceæ*, and their approach to the *Memecylaceæ* and *Melastomaceæ*, are distributable into two subtypes, the *Barringtonidæ* and *Lecythidæ*.

(3133.) The *Barringtonidæ* (or *Barringtoniæ*) differ from the *Lecythidæ* by having the corolla apopetalous, the perigynous stamens slightly monadelphous, the fruit valveless, and the cotyledons large and fleshy.

(3134.) While in the *Lecythidæ* (or *Lecythideæ*) the corolla is catapetalous, the stamens subepigynous, and often connected into a monadelphous ring produced on one side into a petaloid hood. The fruit also is a woody capsule dehiscing transversely, and the leafy cotyledons are plaited, and sometimes folded on the radicle.

(3135.) *Barringtonidæ.* The *Barringtoniæ* are noble trees, natives of Java, China, Sumatra, and other tropical countries. The flowers are splendid, and their seeds, like some of the Myrtaceæ, are remarkable for being pseudo-monocotyledonous, *i. e.* having their lobes conferruminate. *B. speciosa,* which is the *Coutou* of Tahiti, has oily cotyledons, and from them an oil fit for illumination is obtained by expression. The seeds are also used in Tahiti to intoxicate fish.

(3136.) *Gustavia speciosa,* the *Chupa* of New Granada, is a very curious plant, on account of its power of dyeing the skin of persons who feed upon its fruit. For "by eating it the body becomes yellow, and, according to Humboldt and Bonpland, after it remains twenty-four or forty-eight hours, nothing can erase the colour." (*Don.*)

The wood of *G. augusta* and *urceolata* is remarkable for its fetor; and hence it is of little value as timber for domestic use.

(2137.) *Glaphyria nitida* is an elegant tree belonging to this section, but to which type is not absolutely determined. It is "the tree of long life," the *Kayo Umur Panjang* of the Malays, probably so called from its flourishing at elevations where the other denizens of the forest have ceased to exist. In Bencoolen its leaves are used as a substitute for tea; and it is there known to the natives by the name of the tea-plant.

(3138.) *Lecythidæ.* The fruit of *Lecythis* is a large pyxidium, as big as a child's head, and, with its operculum, something resembles an oil-jar, whence the generic name. *L. ollaria* is the greater, and *L. minor* the lesser, cannon-ball trees of Cumana; the former is one of the most gigantic trees in the ancient forests of Brazil, where it is called the Sapucaya. The seeds of all the species are esculent, and they are eaten like chesnuts either raw or roasted, but after they are swallowed they leave an unpleasant bitter taste in the mouth. Monkeys are, however, more fond of them than men, and hence the large seed-vessel full of seeds has been called the "monkey's porridge-pot."

(3139.) The seeds of *L. grandiflora* are very palatable, and do not leave the unpleasant bitter aftertaste, so disagreeable in *L. ollaria,* and those of *L. Zabucajo* are said to be preferable to almonds.

The layers of liber in the bark of *L. ollaria* are easily separable from each

other, and, when well separated by beating, they resemble fine thin satiny paper. The Indians cut these strata in pieces to wrap their cigars in; and Poiteau says he has counted 110 coatings in one piece. The bark of this tree is astringent, and serves to make ink.

The true cannon-ball trees are species of *Couroupita,* the fruit of which is as large as in Lecythis, but the operculum is not separable. The seeds are invested with a soft juicy pulp which is eatable: it has an acid and rather pleasant flavour, and the negroes in Guiana are said to be very fond of it.

(3140.) The flowers of *L. Guianensis* are flesh-coloured, but when torn the lacerated parts become blue on exposure to the air.

The bark of *Couratari Guianensis,* which is the *maou* of Guiana, is so very tough and fibrous, that it is made into cordage by the natives.

(3141.) The Para or Brazil nuts, now so common in the London shops, are the seeds of a noble tree called *Bertholetia excelsa,* in honour of Bertholet, the celebrated chemist. The trunk of this tree varies from 100 to 150 feet in height, and its fruit, which is as large as a cannon-ball or a man's head, is closely packed full of triangular seeds. These seeds have a nutty flavour, and contain a bland oil, which has been expressed for table use.

(3142.) Memecylaceæ. *Memecylon, Scutula,* and *Mouriria,* are associated to form this small type, which is in various ways connected both with the *Gustaviaceæ* and *Myrtaceæ,* which precede, and the *Melastomaceæ* which follow; agreeing with the two former in their unicostate leaves, and with the two latter in having them impunctate. There are other affinities also indicated by their structure, as they have the peculiar long inflexed anthers of the *Melastomaceæ,* and the convolute foliaceous cotyledons of *Granatidæ.* It is also allied to the *Alangidæ* of the *Combretaceæ* in the succeeding section.

(3143.) The *Memecylaceæ* are shrubs with roundish or subtetragonal branches, and opposite, simple, entire, unicostate, impunctate, exstipulate leaves, rarely 3-ribbed, and the petiole slender.

The inflorescence is axillary, pedicellate, either solitary or fasciculate, and the flowers are regular and united. The calyx is superior or adnate to the germen, the tube ovate or subglobose, the limb 4-5-lobed or toothed, or nearly entire, expanded and persistent. The corolla is apopetalous and perigynous, the petals 4-5, exserted from the faux of the calyx, and alternate, with its lobes contorted in æstivation, and deciduous. The stamens are perigynous, exserted with the petals, and double their number, (8-10.) The filaments are free, the anthers 2-celled, long, incumbent, and incurved, and dehiscing either by chinks or pores. The germen is 2-4, rarely 3-celled, the locules 1-2 ovuled, the style single and filiform, and the stigma simple.

The fruit is baccate or subdrupaceous, crowned by the persistent limb of the calyx, indehiscent, 2-4-celled, or by abortion 1-celled, and the cells 1-seeded. The seeds are exalbuminous, the radicle straight and superior, and the cotyledons foliaceous and convolute.

(3144.) Hence, differentially considered, the *Memecylaceæ* are unicostate impunctate *Myrtinæ,* with definite stamens, long inflexed anthers, and convolute foliaceous cotyledons.

(3145.) *Memecylon,* and its allies, are inter-tropical plants, growing in the hottest parts of the East and West Indies, and of their properties there is very

little known, excepting that some, as the *M. edule*, bear pulpy fruits, which are eaten by the natives on the Coromandel Coast, notwithstanding they are too astringent to be pleasant food.

(3146.) It is probable that hereafter *Mouriria* will be more than generically distinguished from *Memecylon*, and considered the normal genus of a new subtype, for it approximates in its structure as much to the *Myrtaceæ* as *Memecylon* does to the *Melastomaceæ*. Thus, in the former, the leaves are unicostate and penninerved, while in the latter they occasionally become 3-ribbed. Hence, as a transitional group, the *Memecylaceæ* are peculiarly interesting.

(3147.) The timber of the *Mouririæ*, especially of *M. Myrtilloides*, is tough, hard, and heavy; *M. Guiana* is called silver-wood, and is used in the manufacture of looms, oars, knife-handles, &c.

(3148.) MELASTOMACEÆ. The numerous genera included in this type form a distinctly characterized and very natural association. They are trees or shrubs, rarely herbaceous plants, with nodoso-articulated and often angled branches, with opposite, simple, in general entire, impunctate, 3- (or more) ribbed leaves, destitute of stipules.

The inflorescence is terminal, usually in thyrsiform panicles, seldom solitary; and the flowers are regular and united.

The calyx is more or less adherent to the angles of the germen, but not cohering with its sides, and thus it forms a number of cavities, within which the incurved anthers remain during æstivation. The tube of the calyx is urceolate, campanulate, or oblong, and persistent; the limb 4-6 or more, commonly 5-cleft, seldom entire, and either persistent or circumscissile, and deciduous. The torus is expanded into a disk, which lines the calyx. The corolla is apopetalous and perigynous, the petals equal in number to the lobes of the calyx, alternate with them and exserted from their base, or from the edge of the disk, contorted in æstivation, and deciduous. The fertile stamens are equal in number to the petals, exserted with them, and alternate with the lobes of the calyx. In addition to these there is usually found an additional series of barren stamens, which are opposite the sepals. The filaments are free, and incurved during æstivation. The anthers are terminal, elongated, pendulous during æstivation, and rostrate, being lengthened out in various ways. The dehiscence is usually by 2 pores at the apex, but sometimes by longitudinal chinks. The ovary is coherent at intervals with the tube of the calyx, formed of as many carpels (seldom less) than there are petals, hence from 2-6-celled. The trophosperms are central, attached to a column, and many-ovuled, the style single, and the stigma capitate or simple.

The fruit is either dry and distinct from the calyx, or succulent and coherent with it: occasionally dehiscent, and then bursting through the valves, which are septiferous. The cells are several, the seeds innumerable, small, subsessile, with brittle smooth testæ, a well-marked raphe or some kind of appendage, and a membranous tegmen. The embryo is exalbuminous, and either variously curved with unequal cotyledons, or nearly straight with the seed-lobes, similar in size.

(3149.) Hence, selecting the chief differential characters, the *Melastomaceæ* are *Myrtinæ*, with definite stamens, long inflexed anthers, concrete carpella, indefinite seeds, and tri- or pluri-costate, impunctate, opposite leaves.

(3150.) The differential characters of the Melastomaceæ are so exclusive, that, as De Candolle observes, notwithstanding the family was formed when few genera

were known, and numerous subsequent additions have been made, they have all been strictly correct, and "no one has ever thought, as too frequently has been the case with other orders, either of putting any part of it into any other group, or even of introducing into it the genera that do not rightly belong to it." Still, exclusive as it is, there have lately been examined some slightly deviating genera that establish its connexion with surrounding types. Thus in the remarkable genus *Sonerila*, the parts of fructification have a ternary disposition, and the leaves in some of its species not ribbed, while in others they are unequal in size, one being small as if tending to abortion, or an alternate arrangement, as in some of the *Melaleucæ*, and *Rhexia Jussiæoides:* and furthermore, *Diplogenea* has traces of the resinous dots characteristic of *Myrtaceæ*, and several genera are now known in which the ovarium is superior, as in the *Punicaceæ*.

(3151.) De Candolle separates the Melastomaceæ into two subtypical groups, which are distinguished by the dehiscence of the anthers.

(3152.) In the *Melastomidæ* the anthers dehisce by apicial pores.

(3153.) In the *Charianthidæ* the dehiscence takes place by longitudinal chinks.

(3154.) The coincidence is peculiar, that this group, like *Proteaceæ*, being large and very natural, containing above eighty genera and several hundred species, should also, like it, contain plants which, although innoxious, are of very little importance either as food, as medicines in the arts, or domestic economy, and yet that they should in a similar manner have been dedicated to some of the most distinguished naturalists of past and present times. Such, for example, as the genera *Davya, Lavoisiera, Cambessedia, Marcetia, Tschudya, Huberia,* and *Marumia;* besides *Graffensiedia, Macairia, Bueguetia, Bertotonia, Meisneria, Spennera, Comolia, Ernestia, Osbeckia, Rousseauxia, Leandria, Clidemia, Ossæa, Sagræa, Lorea, Miconia, Blakea, Ewyckia,* and *Trembleya*, with its subgenera *Abrahamia* and *Jacolbia,* dedicated to the two naturalists of that name.

(3155.) The Melastomaceæ are all of them innoxious plants, a slight degree of astringency is their prevailing quality, and some of them, especially the baccate Melastomæ, bear eatable fruits about the size of gooseberries, containing a very black juicy pulp, that stains both the lips and teeth of those who eat them; and hence the generic name, *Melastoma* or black-mouth. This juice is sometimes, as in *M. Tocaco* or *Tocaco Guianensis,* of so intense a black as to be used instead of ink. A decoction of *M. alatum* is used in Guiana as a lotion to cleanse old ulcers. The fruit of *M. Guianense, spicatum, succosum, flavescens,* and *arborescens,* are all esculent. The flowers of *M. grandiflorum* are esteemed as a pectoral medicine: and the leaves of *M. lævigatum* are used as poultices to punctured wounds. From the down of the leaves of *M. holosericeum* a kind of Amadou is prepared called Yesca of Panama, of which large quantities are transported to Havannah as a profitable article of commerce. The leaves, and indeed all parts of *M. parviflorum* and *M. longifolium,* afford a black dye, and, as well as those of *M. Malabathricum,* are used for dyeing cottons. The leaves of the latter species being astringent are said by Horsefield to be employed as a remedy in India for dysentery and other morbid fluxes. The leaves of *M. Theæzans* are used at Popayan instead of tea; they are aromatic, and are said to form a beverage preferable to that afforded by the China tea-plant. This shrub is hardy,

and might be cultivated in many parts of Europe. Martius informs us that, in Brazil, the name of *Onnianza Pecerica* is given to several of the Melastomas, the juice of whose berries, when fermented, produce wine and vinegar, according to the extent to which the process is carried.

The Macaco-wood of commerce is the wood of *Tococa Guianensis*, the fruit of which is considered an agreeable food by man, and very much relished by monkies; and its juice, as already mentioned, is so black as to be substituted for ordinary ink. The fruit of *Blakea triplinervis* is yellow, and by most persons thought not only eatable but pleasant.

ONAGRINÆ.

(3156.) Six types or natural families of plants, which may in some measure be regarded as regular transitional grades between the coriaceous Myrtinæ and the succulent Crassulinæ, are included in the present section. From *Combretum*, *Vochya*, *Rhizophora*, *Circæa*, *Œnothera* (once called *Onagros*), and *Lythrum*, the respective normal genera of each, these types have received their names, *Combretaceæ*, *Vochyaceæ*, *Rhizophoraceæ*, *Circæaceæ*, *Onagraceæ*, and *Lythraceæ*.

(3157.) Collectively considered, the *Onagrinæ* may be described as being calyciflorus Rosales or *Myrtosæ*, with simple (mostly opposite and exstipulate) leaves, valvate sepals, a symmetrical 1-4-celled adnate germen, (rarely free,) and exalbuminous, or subalbuminous seeds, with a straight embryo.

(3158.) COMBRETACEÆ. *Combretum*, and its allies, which are associated to form the present type, are trees or shrubs, with opposite or alternate, simple, undivided, and coriaceous leaves, sometimes but rarely having pellucid dots, and destitute of stipulæ. The inflorescence is in axillary or terminal fascicles, racemes or spikes, and the flowers regular and united, or if polygamous, it is by abortion. The tube of the calyx is adnate to the germen, and its limb 4-5-lobed, or 5-10-toothed, and valvate in æstivation. The petals are perigynous, alternate with the sepals, and in *Alangium* long and reflexed. The stamens are exserted with the petals from the faux of the calyx, 2 or 4 times as many as the sepals, very rarely equal to them, or 3 times their number. The filaments are free, and the anthers 2-celled, with a longitudinal dehiscence. The disk is annular, and in *Alangium* fleshy at the base of the limb of the calyx. The ovarium is 1-celled, with 2-5-ovules pendent from the apex of the cavity, (without a central column,) the style single, and the stigma simple.

The fruit is drupaceous, baccate, or nut-like, 1-celled, indehiscent, often winged and monospermous. The seeds are large, pendulous, and (except in *Alangium*) exalbuminous; the embryo is straight, the radicle inferior, seldom superior, and the cotyledons foliaceous.

(3159.) The *Combretaceæ*, differentially considered, are hence perigynous *Rosales* or *Myrtosæ*, with exstipulate simple leaves, valvate sepals, a 1-celled inferior ovarium, and mostly exalbuminous seeds.

(3160.) *Alangium*, which differs from all the true *Combretaceæ* by having linear reflexed petals, long protruded stamens, with the anthers often empty, the seeds furnished with fleshy friable albumen, the cotyledons flat and ovato-cordate, and the radicle ascending, has often been separated from all the other plants to form by itself a distinct order (*Alangieæ.*) It seems, however, in the present state of our knowledge, more expedient to consider it a subtype of the *Combretaceæ*, its nearest allies; with which, notwithstanding the above variations, it agrees in numerous particulars as just described, especially in the contracted tube of the calyx, long protruded stamens, concrete carpella, 1-celled drupaceous fruit, and definite pendulous seeds: hence, contrasting the two subtypes into which the combretaceous genera are distributed,—

(3161.) The *Alangidæ* are albuminous *Combretaceæ*, with a 5-10 toothed calyx, 6-10 linear petals, long protruded anthers, and flat cotyledons; while

(3162.) The *Combretidæ* are exalbuminous *Combretaceæ*, with a 4-5 lobed calyx, tetra-or penta-petalous corolla, thick, irregular plaited cotyledons, and hilose radicle.

(3163.) *Alangidæ.* *Alangium decapetalum*, the *Alangi* of the Malays bears an aromatic, agreeable, pulpy fruit, which is esteemed in Malabar. The fruit of *A. hexapetalum* is also eatable, but it has a clammy pulp, and is less pleasant than the preceding species. The roots of both are said to be purgative, and are also valued by the Malays as hydragogues.

(3164.) *Combretidæ.* The apetalous *Combretaceæ* of De Candolle, have already been described among the Querneales as a type of the *Laurinæ*, (1715.) The apopetalous genera are therefore alone included in this subtype. This separation, which is indicated by the structure of the flowers, is also sanctioned by the qualities of the plants; for, while the homely-looking *Terminaliaceæ*, which are useful both in medicine and the arts, are associated with the *Santaceæ*, and other groups of plants possessed of similar properties, the more shewy and elegant but inactive *Combretidæ*, are associated with various other types, which, although handsome ornamental plants, are for the most part as useless as themselves.

(3165.) The various species of *Combretum* and *Quisqualis* are very elegant stove plants, and, from their brilliant flowers, great favorites in our conservatories; but C. (or Poivrea) *alternifolium*, is the only one which has hitherto been applied to any useful purpose. Between the wood and bark of this species, which in Guiana is called *Guayca*, there is found a very viscid tenacious juice, that is sometimes employed instead of glue.

(3166.) Vochyaceæ. *Vochya*, *Qualea*, and their typical allies, are all arboreous plants with opposite branches, the younger ones tetragonal: opposite or whorled, simple, entire, and often coriaceous leaves, narrowed at the base into a short petiole, which is furnished with a pair of stipules. On the summits of the twigs the leaves are sometimes alternate. The inflorescence is usually terminal, in panicles, or racemes, the pedicels bracteate, and the flowers irregular and united. The calyx is either free or partially adherent to the germen, 4-5 sepaled, and imbricate in æstivation. The sepals are combined at the base, the upper one calcarate, and often large and irregular in form. The petals are perigynous, exserted from the base of the calyx, and alternate with its lobes; 1, 2, 3, rarely 5 in number, and in size unequal. The stamens are definite [1-5],

and perigynous, exserted from the base of the calyx and opposite to the petals, rarely alternate with them. In general, 1 stamen only is fertile, bearing a single large ovate 4-celled anther, the others being small and sterile. The ovarium is superior, or half-inferior, formed of 3 connate carpels, and hence is 3-celled. The trophosperms are central, and few-ovuled, each cell containing 1-2 ovules attached to the lower parts of the axis. The style is single, and the stigma undivided. The fruit is capsular, 3-angled, 3-valved, and 3-celled; dehiscent along the middle of the valves, which are septiferous, or at their edges introflexed, and the dissepiments remain attached either to the valves or to the central column. The seeds are exalbuminous, and often winged. The embryo straight and inverted, with large, leafy plicato-convolute cotyledons, and short superior radicle.

(3167.) Hence, differentially considered, the *Vochyaceæ* are deviating *Onagrinæ*, with irregular flowers, the calyx being spurred and imbricate in æstivation, the petals variable in size and number, and the stamens in part abortive.

(3168.) Some doubts exist as to the nearest relations of the *Vochyaceæ*. In habit and flower, as De Candolle observes, they are something similar to *Guttiferæ*, *Hypericinæ*, *Garciniaceæ*, and *Marcgraviaceæ*; and also, as Lindley, remarks, to *Violaceæ*, agreeing with them in their irregular flowers, 3-celled ovary and stipules. But from all these groups they are distinguished by their definite stamens and their convolute cotyledons and inverted seeds, which, added to their perigynous stamens, approach them to the *Combretaceæ*, as well as their stamina being reduced by abortion to one, of which there are analogous instances to be found in the *Lopegiæ* of the *Onagraceæ*, seem indications that their alliance is strongest with these last-named types; and hence they are here associated with them in the section *Onagrinæ*.

(3169.) The *Vochyaceæ* are chiefly the inhabitants of the ancient forests of equinoctial America; some of them have resinous juices, but of their properties there is very little known. The capsules of some of the *Qualeæ* contain a yellow resin; and the bark of other species is used by the Brazilians as a reddish yellow dye.

(3170.) The abortions are curious in the several genera here associated. In *Callsthenie* one petal only is developed, and only one stamen, which exists without any rudiments of those which are sterile in its allies. In *Amphilochia* the corolla is also monopetalous, and the flowers monandrous, any rudiments of the supplemental stamens being rarely found. In *Vochya* the flowers are tripetalous and triandrous, the central petal being the largest and the central stamen fertile, the lateral ones being barren. In *Salvertia* there are 5 petals and 3 stamens. In *Qualea* 1, rarely 2; and in *Erisma* 5, four of which are barren.

The variations in the fruit are also worth notice. In *Callisthene* the valves of the capsule are without a dissepiment, and in the *Amphilochia* they are introflexed at the edges to form dissepiments. In these genera, as well as *Qualea*, *Vochya*, and *Salvertia*, the ovary is free; while in Erisma it is adnate to the calyx. The leaves also in the *Salvertiæ* are destitute of stipules, which is another deviation.

(3171.) RHIZOPHORACEÆ. The *Mangroves* and their associates, which form this type, are trees or shrubs with opposite, simple, undivided coriaceous leaves and interpetiolar deciduous stipules.

The inflorescence is axillary, and the flowers regular and united. The calyx is in general adherent, but occasionally free, with a variously-lobed persistent limb, valvate in æstivation; sometimes, however, forming a calyptra, which is circumscissile and deciduous. The petals are perigynous, exserted alternately with the sepals, and equal to them in number. The stamens are perigynous, equal or double, or triple, the number of the petals, and exserted with them. The filaments are discrete, subulate, and in general erect, but slightly curved in the genus *Olisbea;* and the anthers are ovate and innate. The germen is half-inferior, rarely superior, formed of 2-3 connate carpels, hence 2-3 celled; the cells 2 or many ovuled, and the ovules pendulous. The styles are for the most part connate, and the stigmata either free or coalescent. The fruit is indehiscent, dry, or rarely fleshy, by abortion 1-celled and 1-seeded; and usually crowned by the calyx. The seed is pendulous, and, except in *Cassipourea,* exalbuminous. The radicle is long, the cotyledons flat, and the embryo in general germinates within the pericarp, and before the fruit has fallen from the parent tree.

(3172.) Hence, differentially considered, the *Rhizophoraceæ* are *Onagrinæ,* with valvate sepals, regular corolla, half-inferior, or rarely free germen, an indehiscent, 1-celled, 1-seeded fruit, and opposite leaves, with intrafoliaceous stipules.

(3173.) Although but four genera are included in this type, they differ so materially in structure that they have been distributed into three subtypes, one of which contains two genera, and the other two only one genus each.

(3174.) *Olisbidæ, Olisbeæ,* stands alone in this subtype, which is characterized by having a circumscissile, calyptriform calyx.

Rhizophora Mangle.

A. Branches with flowers and fruit.

(*a*) Flower open to shew the stamens opposite the sepals and petals.

(*b*) The fruit.

(*c*) Section of the fruit shewing the abortive and the fertile cells, and the seed with its double arillus.

(*d*) The cotylidonary leaves spread open.

(*e*) Their axillary buds.

(3175.) *Rhizophoridæ. Rhizophora* and *Carallia,* the *Rhizophoreæ veræ* of De Candolle, are known by having a common adherent calyx.

(3176.) *Cassipouridæ.* *Cassipoura*, on the contrary, has the calyx free, and the seeds albuminous, while in both the other subtypes they are destitute of albumen.

(3177.) The Mangroves are tropical trees, growing on the banks of large rivers, or on the sea-coast, and even within the bounds of the ocean, as far as low-water mark. Their mode of rooting is peculiar : it consists, not like that of ordinary trees, of divisions of the stem below the ground, but as it were of arches of roots above it, so that a more extended base is formed and a firmer hold established in the loose and swampy soil. From the summit of these overbending roots the trunk of the Mangrove springs, like the steeple from the beautiful converging arches of the church of St. Dunstan's in the East.

Thus growing within the sea, or within the influence of the currents of mighty rivers, the final cause of the peculiar economy described in the germination of the seeds within the pericarp, and before the fruit has dropped from the parent bough, is evident; for, were they to be shed as seeds usually are, they would fall into the water, and be carried far from any place that is fitted for their growth. But by the long radicle perforating the pericarp, the seedling plant, when dropped, becomes fixed in the swamp ; and forests of Mangroves are formed of vast extent, unsafe to be trodden by human foot, but over which the savage natives pass, leaping or climbing from root to root for many miles, without once daring to trust their weight upon the treacherous marshy ground. These swamps continually encroach on rivers, lakes, and seas; but, by arresting the exuviæ brought from higher lands, and being as it were the collectors and protectors of the discharged filth of other places, the mangrove bogs become the head-quarters of Malaria, and wherever they are found in abundance, they are certain indications of an unhealthy spot.

(3178.) Captain Basil Hall gives an interesting account of a voyage he made through a forest of Mangroves, and other water-loving trees, which had so encroached upon the sea and river-ways, that pioneers in boats were obliged to precede our traveller to cut a passage for his vessel. In such places the roots of the Mangroves may be seen below the water, and on the ebb of the tide they are left bare, covered with oysters and other shell fish; and he well observes, that by one who has seen such sights much excuse will be made for the wondrous tales of the earlier oriental sailors, who astonished their European friends, and were thought to belie themselves, by affirming that in India oysters and other shell fish grow on trees.

(3179.) The *Rhizophoræ* are astringent plants, and the bark of several, as of *R. gymnorhiza* and *R. Mangle*, are used for dying a reddish brown, or chesnut colour, which, by the action of an iron mordaunt, becomes changed to a permanent black.

(3180.) De Candolle points out the affinity of the *Rhizophoraceæ* with the *Vochyaceæ* and *Combretaceæ*, the immediately preceding types; and also with the *Memecylaceæ* of the *Myrtinæ*, through *Olisbea ; Barraldeia*, sometimes referred to this type, has pellucid dots on its leaves; but this genus, although related to the *Rhizophoraceæ*, seems to be more intimately connected with the *Rutaceæ*. Dr. Brown's series of gradations in structure thus connect *Rhizophora* with *Lythraceæ*, the succeeding type, and the *Cunonidæ* of the following section. [§ 3228.]

(3181.) Lythraceæ. *Lythrum* and its allies are herbaceous, rarely shrubby

plants, with tetregonal or subrotund branches, opposite (seldom alternate,) entire, eglandulose, and exstipulate leaves. The inflorescence is axillary, in cymes or verticillastri, which, by the depauperation of the upper leaves, and the shortening of the internodia, become spiciform thyrsi.

The calyx is persistent, free, synsepalous, with an often campanulate tube and cleft limb ; the lobes valvate or subvalvate, (distant) in æstivation ; and the sinuses of the primary sometimes furnished with secondary lobes. The corolla is perigynous, and the petals, variable in number, are exserted from between the lobes of the calyx, very deciduous, and sometimes absent. The stamens are exserted from the tube of the calyx below the petals, seldom fewer, in general equal to them in number, but sometimes 2, 3, or even occasionally 4 times as many; the anthers are adnate, ovate, 2-celled, and dehisce longitudinally by chinks. The ovarium is free, 2, 4-celled, style filiform, and stigma usually capitate.

The fruit is a membranous capsule, covered by the persistent calyx, and usually 1-celled, and opening either by a longitudinal or irregular dehiscence. The seeds are many (indefinite,) small, exarillate, and exalbuminous, and attached to a central trophosperm. The embryo is straight, the radicle turned towards the hilum, and the cotyledons flat and leafy.

(3182.) Hence, as a general rule, the *Lythraceæ* may be considered as thyrsoid *Onagrinæ*, with free valvate or subvalvate sepals, and an invested membranous capsule.

(3183.) The associated *Lythraceæ* are distributable into two subtypes, called, from *Lythrum Salicaria* and *Lagerstræmia*, the *Lythridæ* [or Salicarieæ,] and *Lagerstræmidæ* [or Lagerstræmieæ.]

(3184.) In the *Lythridæ* the sepals are distant, or only subvalvate in æstivation, the petals occasionally absent, and the seeds apterous.

(3185.) In the *Lagerstræmidæ* the sepals are exactly valvate, the petals never absent, and the seedcoat expanded into a membranous wing.

(3186.) *Lythridæ.* Most of the genera included in this subtype are astringent, and the leaves of *Lythrum Salicaria* have been thought to be serviceable in *hæmoptysis* and diarrhœa. The flowers of *L. Hunteri*, which are of a beautiful red, are used in India, when mixed with those of *Morinda*, as a dye, there called *Dhawry ;* and in Mexico other species are employed as styptics and vulneraries.

(3187.) *Ammannia vesicatoria* has very acrid juices, and its leaves, which have a powerful smell, resembling muriatic acid, are used by the native doctors in India to raise blisters on the skin. Vesications are produced by their application in less than half an hour, and they are in great repute as a remedy in chronic rheumatism.

(3188.) The *Heimiæ* are remarkable for having yellow flowers among a group in which the petals are almost universally either red or purple. *H. syphilitica* is affirmed to be a powerful diaphoretic and diuretic, exciting the action both of skin and kidneys in an extraordinary manner. It is also reputed to have almost a specific influence over certain cachectic disorders. The Mexicans call it Hanchinot.

(3189.) The ordinary rose-wood, Rosen-holz, of commerce, is said by Don to be the timber of one of the very few arboreous plants contained in this type, and called by botanists *Physocalymnia floribunda ;* the generic name having reference to the covering afforded to the buds before expansion by the inflated

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bracteæ. This plant is a native of Brazil; in the province of Goyaz it is called *Cego machado,* and in that of Rio Janiero *Pao de rosa.*

Rosewood is one of the dearest as well as the most beautiful of the fancy woods, and hence it is in great request for various ornamental purposes. Its price in bond varies from about 120*l.* to 125*l.* per ton; and as the duty at 10*l.* per ton produced, in 1830, 10,491*l.* 19*s.* there must have been 1,049 tons entered that year for home consumption, besides what had been brought here for exportation.

(3190.) *Lawsonia alba,* which some persons suppose to be the *Gopher* of Scripture, is the plant that affords the celebrated Henna or *Al-hanneh* of the Arabs. It is a curious fact that the unarmed variety, *L. inermis,* should be spread over Egypt, Persia, and India, and be found even in America; while the *L. spinosa* is confined to the New World. A paste made of the pounded leaves of this plant is much used by the Egyptians, Arabs, and Turks, to dye their nails of a yellowish dark-red hue. This practice can be traced to a very high antiquity, for there is evidence that the nails of mummies have been so dyed. It does not seem that the women use henna either to heighten their own beauty or to render their children more lovely, but rather as a mark of dignity, as slaves are forbidden to employ it. From the great esteem in which henna is held, and its vast consumption as an article of the toilet, it is cultivated expressly in Egypt for export to Constantinople, and yields the Pacha a considerable revenue. Henna is also used to colour the manes of horses, as well as to dye wool and leather. It contains no tannin, but is astringent, and, from the gallic acid which is present in its juice, it forms a black dye with the salts of iron. In India the leaves of henna, both taken internally or externally applied, are reputed to be efficacious in removing cutaneous disorders, especially those of a leprous character. The flowers have a strong, and to most Europeans a disagreeable odour; but, notwithstanding their powerful hircine smell, the oriental ladies use a water distilled from them as a cosmetic, and put them in beaupots to perfume their apartments.

(3191.) *Antherylium* is a plant chiefly interesting from its having almost an equal right to be placed along with *Cassipouriæ* among the *Rhizophoraceæ,* as here *Peplis. Ameletia, Suffrenia,* and *Rotala,* are noticeable for having apetalous flowers; and in *Chrytotheca* the petals are minute, and sometimes abortive.

(3192.) *Lagerstrœmidæ.* Two genera only, viz. *Lagerstrœmia* and *Lafœnsia* are contained in this subtype, and not any of the species of either are known to have been hitherto applied to any useful purpose. They are, however, very ornamental plants.

(3193.) Onagraceæ. The plants included in this type are herbs or shrubs, with simple opposite or alternate leaves; sometimes entire, and at others toothed or pinnatifid, impunctate, and destitute of stipules.

The inflorescence is axillary or terminal, and either spicate or racemiform. The flowers are regular, mostly united, and variable in colour. The calyx is adnate to the germen, either throughout the whole length of its tube, and often drawn out beyond the ovarium, or coherent only at its base. The limb is 4-lobed and valvate in æstivation. The petals perigynous, exserted from the tube of the calyx, equal in number to the lobes, and alternating with them; regular and twisted in æstivation, rarely absent. The stamens usually double the number of the petals, but sometimes fewer. The filaments are free and filiform, and the

anthers oblong or ovate; 2-celled, exappendiculate, and opening by longitudinal chinks; the pollen triangular, and usually cohering by threads; the germen is inferior, 2 or many celled, and many ovuled; the style is filiform, and the stigma capitate or 4-lobed.

The fruit is capsular, baccate or drupaceous, 2-4 celled, the seeds numerous and attached to a central placenta; the albumen is almost universally absent, but the eudopleura is sometimes tumid and simulates albumen. The embryo is straight, the radicle long and round, and the two cotyledons short.

(3194.) Hence, selecting the chief differential characters, the *Onagraceæ* are *Onagrinæ* with an inferior 2-4 celled germen, valvate sepals four in number, and the seeds many, attached to a central trophosperm.

(3195.) The genera here associated are distributable into five subtypes, named, after their respective normal genera, *Montinia*, *Fuchsia*, *Onagra*, *Jussiæa*, and *Lopezia;* and of these the following are the chief differential characters.

(3196.) The *Montinidæ* are trees or shrubs with alternate leaves, capsular fruit, and numerous imbricate erect seeds, furnished with wings.

(3197.) The *Fuchsidæ* are trees or shrubs with opposite leaves and baccate fruit, the tube of the calyx being produced beyond the ovarium.

(3198.) The *Onagridæ* are herbaceous or suffruticose plants, with a capsular fruit, seeds many and wingless (though sometimes comose), the tube of the calyx produced beyond the ovarium, and the stamens double the number of the petals.

(3199.) The *Jussidæ* are herbaceous, rarely suffruticose plants, with a many-seeded capsular fruit, and the tube of the calyx not produced beyond the ovarium, but at once dividing into a 3-6 cleft limb.

(3200.) The *Lopezidæ* are herbaceous plants, with an ovate-globose capsule, monandrous flowers, the second stamen being abortive and petaloid, and the tube of the calyx not produced beyond the ovarium.

(3201.) The *Onagraceæ* are all innocuous plants, but they are more celebrated for their beauty than for their medical or economical importance. Many of them, such as the *Fuchsia, Epilobium, Gaura, Clarckia,* and *Lopezia,* are highly ornamental plants. *Montinia acris,* which is remarkable for having albuminous seeds, likewise deviates from the other genera in having an acrid fruit. Of the Epilobia or Willow herbs, the *E.* or *Chamænerion angustifolium* is said to produce a kind of intoxication, or to stupify those who drink a decoction of its stems and leaves; and hence perhaps the reason why it is added by the Kamtschatdales to "enrich the spirit" they prepare from the cowparsnip. The pith when dried becomes sweet, and the same people brew from it a kind of ale, and also procure their vinegar. The young shoots of this and other species are eatable when dressed in the same manner as asparagus. The *Epilobia* are valuable plants for shrubberies, as they will thrive under the drip of trees, and by their brilliant flowers enliven and form an admirable contrast with the more sombre foliage of shady walks. They are also very tolerant of smoke, and thrive well in large towns. The roots of the *Œnothera,* especially *Œ. biennis,* are also esculent. The plant was once cultivated for the sake of its tubers, which might in some measure have stood in the stead of the potato, had they not been superseded by the introduction of the latter most valuable plant. The roots of this *Œnothera* were formerly eaten after dinner, as olives now are,

being esteemed incentives to wine-drinking; and hence the generic name was changed from *Onagra*, the ass-food, to *Œnothera*, the wine-trap.

The leaves of *Jussiea Peruviana* are esteemed in America for making good emollient poultices.

(3202.) Circæaceæ. *Circæa*, the enchanter's night-shade, usually associated with *Lopezia*, differs from the rest of the *Onagraceæ* in so many important particulars, that Lindley has separated it from them to form his *Circæaceæ*, a type which it is probable will be generally adopted.

(3203.) The *Circæaceæ* are herbaceous plants with opposite toothed petiolate leaves destitute of stipules. The inflorescence is terminal or lateral, and in racemes covered with uncinate hairs, and the flowers are united. The calyx is superior, with a 2-parted deciduous limb. The petals are 2, and alternate with the sepals; the stamens 2, alternate with the petals, and perigynous. The disk is large, cupshaped, fills the entire tube of the calyx, and even projects beyond it. The ovarium is 2-celled, with one ovule in each cell; the style simple, arising out of the disk, and the stigma emarginate. The fruit is 2-celled, 2-valved, and 2-seeded. The seeds solitary and erect, the embryo erect and exalbuminous, and the radicle inferior and short.

(3204.) Hence, differentially considered, the *Circæaceæ* are disepalous, dipetalous, and diandrous *Onagrinæ*, with a 2-celled inferior ovarium, definite erect, ovula, and a short radicle.

(3205.) Notwithstanding the *Circææ* have been named after the famous mythological enchantress Circe, they are entirely innocuous plants, possessing neither deleterious nor useful properties of any kind; and their only charms are those dependent on their flowers, and they are not very great.

CRASSULINÆ.

(3206.) Various plants with succulent fleshy leaves were associated by Linneus in his 13th natural order *Succulentæ*. These, with some modifications, were distributed by Jussieu into five smaller groups, that are nearly coincident with the types associated to form this section; and as the types are in some measure comparable to the minor orders of Jussieu and the suborders of Linneus, so the section itself may be compared to the more comprehensive group of the latter.

But as many succulent plants were never included in the order, and as some of those which it contains have not fleshy leaves; and, above all, as the associating characters are now drawn from more important organs than the leaves,—whence considerable changes have been necessarily made by modern systematic reformers in the arrangements both of Linneus and Jussieu, and the general name *Succulentæ* frequently restrained to a special subdivision,—Crassulinæ, from *Crassula*, a well-known genus, may form a preferable collective term.

(3207.) Differentially considered, the *Crassulinæ* are perigynous *Rosales* or *Myrtosæ*, with succulent or subsucculent leaves, imbricate, rarely valvate sepals, definite carpella, distinct at their apices, and the seeds albuminous and many (seldom few.)

(3208.) The genera included in this section have been distributed into about sixteen or seventeen small natural families, here called subtypes, which are asso-

ciable into seven larger groups or types. These, from *Hydrangea*, *Hamamelis*, *Saxifraga*, *Crassula*, *Mesembryanthemum*, *Portula*, and *Fouquiera*, the normal genera of each, are called *Hydrangeaceæ*, *Hamameliaceæ*, *Saxifragaceæ*, *Crassulaceæ*, *Mesembryaceæ*, *Portulaceæ*, and *Fouquieraceæ*, respectively.

(3209.) HYDRANGEACEÆ. *Philadelphus* and *Hydrangea*, which, with their respective allies, form two small natural groups of plants usually set wide apart in systematic arrangements, are here associated to form the present type. Linneus indeed included *Hydrangea* among his *Succulentæ*, and De Candolle, who follows him in connecting it with the *Saxifrages* of the *Crassulinæ*, also hints at its

A. *Sempervivum montanum*. Entire plant with offsets.

(*a*) Many-petaled corolla with perigynous stamens.

(*b*) Carpels with calyx.

(*c*) A carpel separated.

(*d*) Carpel cut open to shew the numerous seeds.

(*e*) A seed.

(*f*) A transverse section.

(*g*) A longitudinal section to shew the straight embryo included in the axis of the albumen.

B. *Mesembryanthemum albidum*. Entire plant, shewing succulent simple radicle leaves, and terminal flowers with indefinite petals.

(*a*) Section of the flower, to shew its stamina, pistils, numerous ovules, and half-adherent calyx.

(*b*) The calyx, including the ovary, deprived of the corolla, stamens, &c.

(*c*) Transverse section, to shew the concrete carpels.

(*d*) The fruit surrounded by the persistent calyx, which is half-adherent.

(*e*) Transverse section of the fruit, to shew that it is plurilocular.

(*f*) A seed with its podosperm, enlarged.

(*g*) Longitudinal section, to shew the curved embryo, lying at the side of the albumen.

affinity to *Philadelphus*, but without determining on their approximation. Hence the *Philadelphidæ*, although now excluded from the *Myrtaceæ* with which they were for a long time confused, and attached to the *Saxifragaceæ*, to which they are more nearly related in their fructification, notwithstanding their difference of habit, become the transitional grade between this section and the last.

(3210.) The *Hydrangeaceæ* are shrubs, with opposite, exstipulate, simple, impunctate leaves. The inflorescence is terminal or axillary, in cymes or panicles, and the flowers in general regular and united, or separate by abortion when the sterile ones become radiant.

The calyx is adherent to the germen, the limb 4-10-cleft, for the most part persistent, and valvate in æstivation. The corolla is apopetalous and perigynous, the petals alternate, with the lobes of the calyx equal to them in number, and

imbricate in æstivation. The stamens are perigynous, 10-40 in number, and exserted from the faux of the calyx in one or two series. The germen is inferior or half-inferior, the styles more or less discrete or connate, and the stigmata 2 or many.

The fruit is capsular, rarely baccate, 2-10-celled and polyspermous, with oftentimes angular placentæ. The seeds are albuminous; in the *Philadelphidæ*, they are subulate and scobiform, with smooth testæ covered by a loose membranous arillus, and crowded in heaps on the angular placenta; in the *Hydrangidæ* they are many, but less multitudinous, exarillate, and furnished with curiously reticulated testæ, such as are peculiar to these plants and the *Begoniaceæ*. The albumen is fleshy, the embryo inverted, the radicle round and superior, and the cotyledons flattish, ovate, and short.

(3211.) Hence the *Hydrangeaceæ*, differentially considered, are fruticose *Crassulinæ*, with opposite, exstipulate leaves, valvate sepals, imbricate petals, concrete carpella, indefinite seeds, and straight superior radicles.

(3212.) The two subtypes, *Hydrangidæ* (or Hydrangeæ,) and *Philadelphidæ* (or Philadelpheæ of De Candolle), differ in the following particulars.

(3213.) In the *Philadelphidæ* the stamens are many (20-40), the fruit semi-adnate and always capsular, 4-10-celled, and the numerous seeds smooth and arillate.

(3214.) In the *Hydrangidæ* the stamens are few (10), and the fruit either baccate or capsular, adnate, and 2-5-celled, the seeds exarillate, and the testæ reticulate.

(3215.) *Philadelphidæ.* The (φιλαδελφος) *Philadelphus* of Aristotle, a tree now unknown, is said to have been so called after the Egyptian Ptolemy of that name. The present *Philadelphi* are very ornamental shrubs, possessed of no remarkable deleterious or useful properties; but some, such as *P. coronarius*, are so strongly scented as to cause headach when introduced into beaupots or kept in confined rooms. From the odour of the garden species resembling that of orange flowers when at a distance, they have been called mock-oranges, which is a better name than the common one of *Syringa*, which belongs to the lilac.

(3216.) *Hydrangidæ.* The *Hydrangeas*, like their allies, are chiefly valued as ornamental garden plants; but they are in general depauperated in this country, from the very scanty supplies of water which gardeners usually afford. They are marsh plants, transpire freely, and a well-grown individual should have from 10 to 12 gallons of water daily in warm weather. The *Hydrangea* has been introduced from China and Japan, where it is cultivated to a considerable extent; but it has not hitherto been found in a wild state.

B

(3217.) Under culture the Hydrangeas being propagated by cuttings, the flowers which are over-developed in the envelopes, are almost always barren; they are likewise very variable in their colour, passing through every shade of green and blue to red. Red is their natural and most common colour; in poor soil they become of a dirty dingy green, but when grown in

peat-earth, turf-ashes, and especially the ashes of fir-trees, or in yellow loam, or if watered with alkaline solutions, the flowers assume a rich blue tint, and are, from the large bunches in which they grow, very handsome.

(3218.) HAMAMELIACEÆ. The witch-hazel, *Hamamelis*, is the normal genus of a very small group, concerning the immediate affinities of which botanists are not as yet generally decided. It is connected in some respects with the *Araliaceæ*, and by the occasional abortion of petals, as well as in habit, to the Rhamni and Euphorbiæ, and even to the amentaceous Querneales. But this degeneracy in the flowers is not unfrequent in the *Crassulinæ*, with which, especially with the *Saxifrages*, they have, as will be seen on comparison, many characters in common.

(3219.) The *Hamameliaceæ* are shrubs with simple alternate leaves, either exstipulate or furnished with deciduous stipulæ. The inflorescence is axillary and fasciculate, the flowers small, usually united, but occasionally diclinious and polygamous by abortion. The tube of the calyx is more or less adherent to the ovarium, and the limb 4-lobed or widely toothed, and imbricate in æstivation. The corolla (rarely absent) is 4-petaled, and the petals linear, exserted from the faux of the calyx, alternate with its lobes, and valvate-involute in æstivation. The stamens are definite, in general 8 in number, 4 of which are opposite the sepals, and the other 4 sterile; when the petals are absent the stamina are increased in number threefold, the supernumerary ones being probably formed by conversion from petals. The filaments are short, and the anthers introrse and variable in their dehiscence, each cell in general opening by a deciduous valve. The ovary is adnate to the calyx at the base, 2-celled, and the ovules solitary and pendulous. The styles are 2 (rarely 3), and the stigmata simple.

The fruit is capsular, half-inferior, 2-celled, 2-valved, uncovered by the calyx at the summit, where the carpels separate, and in general dehisce by septiferous valves. The seeds are solitary and pendulous, and the albumen horny. The embryo is straight and axile, enclosed within the albumen, the radicle is superior, and the cotyledons flat and foliaceous, or subinvolute, at the margins.

(3220.) Hence, differentially considered, the *Hamameliaceæ* are stipulate *Crassulinæ*, with involute-valvate petals, a half-inferior 2-celled ovary, and solitary seeds.

(3221.) The polypetalous genera, *Hamamelis*, *Dicoryphe*, and *Trichocladus*, in which the stamens are few in number, half-sterile, and the anthers of the fertile ones dehisce by deciduous valves, form the subtype *Hamamelidæ*.

(3222.) While Fothergilla, which is apetalous with many (24) stamens, all fertile, and anthers dehiscent by chinks, forms the subtype *Fothergillidæ*.

(3223.) Little is known of the general properties of these plants. The bark of *Hamamelis Virginica*, which is bitter and astringent, has been employed medicinally; and poultices made of it, when reduced to a pulpy state, are said to prove sedative, and to relieve pain in inflammatory tumours.

(3224.) SAXIFRAGACEÆ. *Saxifraga*, and its typical allies, are trees, shrubs, or herbaceous plants, of varied habits, but strongly associated by general characters. Their leaves are opposite or alternate, in general simple and exstipulate, but occasionally compound, and furnished with interpetiolar stipules. The calyx consists of 5 (seldom 3-7) sepals, more or less connate, and adnate to the germen, which is sometimes inferior, sometimes half-inferior, and sometimes free; the

limb is lobed or toothed, often persistent or marcescent, and imbricate in æstivation. The petals (marcescent, deciduous, or rarely 0,) are equal in number to the sepals exserted from the tube of the calyx, and alternate with its lobes. The stamina are perigynous, exserted from the calyx, when equal in number to the petals alternate with them, when double the supernumerary ones are opposite. The filaments are subulate, and the anthers ovate and 2-celled, rarely 1-celled, and dehiscent either by pores or chinks. The germen consists of 2 (rarely 3-5) concrete carpels; the styles, equal in number to the carpels, are mostly distinct (but sometimes connate) and persistent; and the stigmata are capitate or club-shaped.

The fruit is a 2- (rarely 3-5) valved capsule, the margins of the valves or carpellary leaves being more or less introflexed, and forming accordingly either two complete cells or two semi-complete locules, or one cell only. When dehiscent the valves open either from the base or apex; or sometimes the dehiscence is circumscissile. The seeds are mostly indefinite, the albumen fleshy, the embryo small, the radicle short and turned towards the hilum; and the cotyledons short and ovate.

(3225.) Hence the *Saxifragaceæ*, differentially considered, are *Crassulinæ*, with imbricate sepals, mostly few, connate carpels, many seeds, straight embryo, and short hilose radicle.

(3226.) The genera here associated are distributable into four or five minor groups or subtypes, sometimes separated to form distinct orders, but it appears more expedient to consider them, with De Candolle, as only subordinate tribes; his *Hydrangeæ* are however excluded, as the Philadelphidæ are their nearest allies, and their valvate sepals would render them abnormal here. *Escallonia*, *Cunonia*, *Bauera*, *Saxifraga*, and *Heuchera*, are the normal genera of these five subtypes, which hence are called the *Escallonidæ*, *Cunonidæ*, *Baueridæ*, *Saxifragidæ*, and *Heucheridæ*, respectively.

(3227.) The *Escallonidæ* are trees or shrubs, with alternate, simple, exstipulate leaves, penta-synpetalous and pentandrous (rarely hexapetalous and hexandrous) flowers, concrete carpels, and indefinite seeds.

(3228.) The *Cunonidæ* are trees or shrubs, with opposite leaves, interpetiolar stipules, definite stamens, concrete or discrete carpels, 2 or many seeds, and a- or apo- petalous flowers.

(3229.) The *Baueridæ* are shrubs, with opposite, exstipulate, compound leaves, indefinite stamens, anthers dehiscing by apicial pores, and a 2-celled capsule dehiscing at its apex between the styles.

(3230.) The *Saxifragidæ* are herbaceous plants, with alternate, rarely opposite, exstipulate leaves, definite stamens dehiscing by chinks, and 2-celled capsules.

(3231.) The *Heucheridæ*, which are deviating *Saxifragidæ*, differ from them chiefly in having a 1-celled capsule, and sometimes apetalous and irregular flowers.

(3232.) Astringency seems to be the only active principle possessed by the *Saxifragaceæ*; in some, as in *Heuchera* and *Weinmannia*, it is so accumulated that the *H. Americana* is called alum-root, and used as a styptic and as an escharotic in cases of cancer; and several species of *Weinmannia* are employed in the manufacture of leather, as well as to adulterate Peruvian-bark. Others are simply mucilaginous, such as the *Saxifrages*, which, notwithstanding their

name, possess no lithotriptic powers. And, if they ever afforded relief to sufferers with stone in the bladder, what exceeded the effects of a cooling mucilage must be attributed to the influence of the mind.

The granulate roots of the common Saxifrage, resembling as it were small stones, was confirmation strong to the signature physicians of the potency of the plant in calculous complaints; and as its white flowers indicated that it was "governed by the moon," its credit remained long unquestioned by such as, led by the astrologers, believed that the heavens

> "Shed down their stellar virtues on all plants
> That grow on earth, made thereby after to receive
> Perfection from the sun's more potent ray."

(3233.) Saxifrage is a very extensive genus, and various attempts have been made to break it up into several genera, but their affinity is so close and the gradations so complete, that it seems preferable to consider most of them only as subgeneric groups, and this distinction their difference in habit would appear to justify.

The *Saxifragaceæ* are chiefly mountain-plants, and although not of much economical utility, they are for the most part remarkable for delicacy and beauty. The house-leek used formerly to be planted on the roofs of dwellings, barns, and sheds, for the express purpose of protecting them from injury by lightning. From what the opinion arose we know not; but the practice is still continued, although confidence has been transferred to other conductors. *Chrysosplenium* also was once famed for its supposed influence over melancholy, and other presumed diseases of the spleen. It is said to be both aperient and diuretic, but not very powerfully so, as would seem to be shewn from its common use as a salad in the Vosges, where it is freely eaten under the name of *Cresson de Roche*.

The *Chrysosplenia* are noticeable for their want of petals; and Adoxa, often referred to the Saxifragidæ, is also apetalous. Its proper place, however, appears to be among the *Araliaceæ*.

(3234.) Crassulaceæ. *Crassula*, and its questionable allies, *Galax* and *Cephalotus*, are the normal genera of three small groups, here considered subtypes, and associated to form the natural family called, from the first-named, *Crassulaceæ*. Of their affinity there can be no doubt. *Francoa*, the associate of *Galax*, is closely allied to the *Crassulidæ*, and *Cephalotus*, now that the structure of its ripe fruit and seeds has been examined, can no longer be referred to the *Rosaceæ*, but appears, on the authority of Dr. Brown, to be more nearly connected with the *Crassulidæ*, between which and *Francoa*, of the *Galacidæ*, he suggests it should be placed.

(3235.) The *Crassulaceæ* are herbaceous plants or shrubs, with mostly succulent, radical, exstipulate leaves, either simple or divided, and in one subtype furnished with ascidia.

The inflorescence is axillary or terminal, and spicate or racemose, occasionally in sessile cymes, and the flowers are regular, and in general united.

The calyx is free, often persistent, synsepalous and 4-6-cleft, and imbricate in æstivation. The corolla when present is perigynous, and imbricate in æstivation; in one subtype (*Galacidæ*) apopetalous, in another (*Crassulidæ*) catapetalous, and in the third (*Cephalotidæ*) the flowers are apetalous. The stamens are

perigynous, exserted from the tube of the calyx, and equal to, double, or four times as many as, its lobes, in the first case alternate with the sepals, in the other alternately irregular in size, or alternately barren, or accompanied by hypogynous scales, (? abortive stamens.) The filaments are subulate, free, or monadelphous, and the anthers subrotund, 2- (rarely 1-) celled, and dehiscent by longitudinal chinks. Ovaries equal in number to the petals, or when they are absent, to the sepals, and alternate with them; either free or sub-connate, 1-celled, and 1 or more seeded; style or stigma terminal.

The fruit consists either of free akenia or a whorl of follicles, which, when concrete, form a 3-4-celled capsule, with 3-4 septiferous valves. The seeds are variable in number, albuminous, the embryo straight, and the radicle turned towards the hilum.

(3236.) Hence, selecting the chief general characters, the *Crassulaceæ* are herbaceous or shrubby *Crassulinæ*, with a free calyx and definite stamens; carpels several, equal in number to the petals or sepals, for the most part free, rarely connate, and the embryo straight.

(3237.) The *Galacidæ* are apopetalous *Crassulaceæ*, with stamens alternately barren and fertile, sometimes monadelphous, sessile lobed stigmata, concrete carpella, forming a 3-4-celled polyspermous capsule.

(3238.) The *Cephalotidæ* are apetalous *Crassulaceæ*, with the stamens alternately of different lengths, discrete carpels, with terminal styles, becoming 1- rarely 2-seeded akenia, the albumen friable, and the leaves ascidiate.

(3239.) The *Crassulidæ* are mostly succulent *Crassulaceæ*, with often catapetalous corollæ and irregular stamens, furnished with hypogynous scales; the carpels are discrete with terminal styles, and become follicles; the albumen also is fleshy.

(3240.) The development of the flowers in these three subtypes affords a curious example of the several forms which the successive whorls of metamorphosed leaves assume. In *Galacidæ* the stamens are alternately barren, as if halting between two states, and not becoming absolutely either petals or scaly nectaries. In the *Cephalotidæ* the petals are absent, but the sepals are coloured (white), and the stamens are alternately longer and shorter, those alternating with the lobes in the situation of the petals being longer, earlier in their development and maturity, than those which are opposite the sepals. And in the *Crassulidæ*, where the petals are often connate, as the filaments are in *Galacidæ*, those alternate with the sepals as in *Cephalotidæ* are shorter than those which are opposite to them. The sterile filaments of the *Galacidæ* are likewise represented by the hypogynous scales of the nectary in the *Crassulidæ*. And these scaly productions would seem to be forerunners of the elaborate and beautiful nectaries of *Parnassia*, which has sometimes been associated with the Saxifrages.

(3241.) The *Crassulaceæ* in general are refrigerant, and slightly astringent. Hence several, such as *Crassula tetragona*, *Sedum Telephium*, *S. album*, *Sempervivum tectorum*, &c. have been commended, when boiled in milk, as remedies in diarrhœa. House-leek and cream is a favorite provincial application in cases of St. Anthony's fire. Some species have acrid juices, such as *Sedum acre*, and we are told that, in Madeira, the fresh leaves of *Sempervivum glutinosum* are used by the fishermen to rub their nets with, which, if they are subsequently steeped in urine or any alkaline liquor, become as durable as if they were tanned.

(3242.) *Cephalotus follicularis* is one of those very curious plants, the leaves of which bear or form ascidia, whence their common name of pitcher-plants. But, extraordinary as these organs are, especially when furnished with lids or opercula, as in *Cephalotus*, *Nepenthes*, and *Sarracennia*, they do not, as Dr. Brown observes, appear to indicate any natural affinity between the plants that bear them; for, although the flowers in the former two are both apetalous, and deviate from the quinary arrangement of parts so prevalent among the Rosares, they differ in so many other particulars, that it would be futile to attempt a comparison: and with *Sarracennia*, save their ascidia, they have neither of them anything in common.

(3243.) *Cephalotus* is a native of New Holland, growing in marshy districts in the neighbourhood of King George's Sound, especially near the shores of Prince Royal Harbour. In the appendix to "Flinder's Voyage," where Dr. Brown has described this plant, originally however discovered by Labillardière, he says, "The ascidia or pitchers of Cephalotus were observed to be in general nearly half filled with a watery fluid, in which great numbers of a small species of ant were frequently found drowned. This fluid, which had a slightly sweet taste, may possibly be in part a secretion of the pitcher itself, but more probably consists merely of rain-water received and preserved in it. The lid of the pitcher, in the full-grown state, was found either accurately closing its mouth or having an erect position, and therefore leaving it entirely open; and it is not unlikely that the position of the lid is determined by the state of the atmosphere, or even by other external causes."

(3244.) MESEMBRACEÆ. The fig-marygolds or mid-day-flowers, named, from their usual time of flowering, *Mesembryanthema*, form, with their immediate allies *Tetragonia*, *Sesuvium*, and *Aizoon*, the present type, to which the deviating genus *Nitraria*, and perhaps *Reaumuria*, may be also added. These plants, which are part of the *Succulentæ* of Linneus, were called *Ficoideæ* by Jussieu; but this is an objectionable name, and the normal genus will afford a better term.

(3245.) The *Mesembraceæ* or *Ficoideæ* are herbaceous plants or undershrubs, with opposite or alternate, fleshy, simple leaves; of very various and often grotesque forms, and destitute of stipules.

The inflorescence is for the most part terminal, seldom axillary, and the flowers are regular and united. The sepals are definite, usually 3 in number, but varying from 4-8, more or less connate at the base, quincuncial, rarely valvate in æstivation, and either free or adherent to the germen. The petals mostly indefinite and often connate, sometimes 5, alternate with the sepals, and occasionally abortive when the inner part of the calyx is coloured. The stamina are indefinite and perigynous, the filaments free, and the anthers oblong, incumbent, 2-celled, the locules being opposite and parallel, and dehiscing longitudinally. The ovarium is either free or adherent to the calyx, and consists of as many (seldom more) carpels as there are sepals. The trophosperms are angular, form a central column, and are multiovulate. The styles are distinct and short, and the stigmata simple.

The fruit is a many-celled capsule, either free or encompassed by the fleshy calyx. When drupaceous, indehiscent; when dry, dehiscing in a stellate manner from the apex, rarely circumcissile; seeds indefinite, seldom definite, and very seldom solitary by abortion. The albumen is farinaceous, rarely absent, the

embryo curved and lateral, (in Glinus spiral, and in Nitraria and Reaumuria straight,) and the radicle is hilose.

(3246.) Hence, differentially considered, the *Mesembraceæ* are succulent *Crassulinæ*, with a- or poly-petalous flowers, numerous stamens, 5 or more, concrete carpels, and a curved or spiral, seldom straight, embryo.

(3247.) The genera here associated are distributable into two or three subtypes.

(3248.) The *Mesembryanthidæ*, in which the leaves are opposite the flowers, the corollæ a- or poly-petalous, the albumen mealy, and the embryo curved or spiral.

(3249.) The *Nitraridæ*, in which the leaves are alternate, the flowers 5-petaled, the seeds exalbuminous, and the embryo straight.

(3250.) The *Reaumuridæ*, in which the leaves are alternate, small, and scale-like; the sepals imbricate in æstivation, the corolla 5-petaled, the stamina hypogynous, the albumen mealy, and the embryo straight.

(3251.) *Nitraridæ*. *Nitraria*, by its straight embryo, is evidently transitional from the Crassulaceæ to this type. It deviates so much by its alternate leaves, definite petals, and exalbuminous seeds, from the *Mesembryanthidæ*, that it is well it should be subtypically distinguished, although, from its general agreement with them, it cannot be far removed.

The *Nitrariæ* are natives of the sandy plains of Africa and Asia; they are slightly saline plants; but, if possessed of any important properties, they are as yet to be discovered.

(3252.) *Mesembryanthidæ*. The fig-marygolds, included in the genus *Mesembryanthemum*, are plants with very strange and curious leaves, but furnished with most beautiful flowers. Upwards of 300 species are already known, and many of them are great favorites with cultivators here. *M. crystallinum* is the common ice-plant, and *M. umbellatum* is extremely handsome. They are all innocuous, and the succulent leaves of some, as *M. edule*, *Sesuvium*, *Portulacastrum*, *Tetragonia expansa*, &c. would make excellent substitutes for summer spinach; and they are used as such by the Hottentots. *M. edule* is also eaten by them; and has hence, by the colonists at the Cape, been called the "Hottentot's fig." From the leaves of *M. emarcidum*, which they bruise and ferment, the Hottentots prepare a substance which they chew like tobacco, not only to quench their thirst, but to produce intoxication; and this inebriating material is an article to them of some commercial importance.

The leaves of *M. crystallinum* are eaten in many places; and, in the Canaries, Broussonet tells us that the Guanches powder the seeds and eat them as their common food. In Spain this plant is called *Barilla Moradera*, and is cultivated to a great extent for the purpose of procuring alkali for the glass-works; and in one year the exports of its ashes from the Canary Islands amounted to 600,000 francs. *M. nodiflorum*, which grows wild in Egypt and Italy, is burned in the former country for a similar purpose. It is also used in the manufacture of Maroquin, or Morocco leather, which probably owes its peculiarities to the salt contained in the material with which it is dressed. In the sandy plains where these plants grow they afford a grateful pasturage for flocks.

(3253.) *Reaumuridæ*. Although *Reaumuria* is associated with the *Mesembryanthidæ* by De Candolle, the propriety of its location in the type is very questionable. In habit and properties it is, however, very like *Nitraria;* and until

its affinities are more clearly made out, it may be permitted to maintain its place, with the protest that it forms an aberrant group. Like the *Nitrariæ*, the *Reaumuriæ* are saliniferous plants; and one species, *R. vermiculata*, is remarkable for its abundant secretion of saltpetre and common table-salt.

(3254.) PORTULACEÆ. The Purslane (*Portulaca*) and its allies are succulent herbs or shrubs, with fleshy, entire simple leaves, alternate, rarely opposite, and usually destitute of stipules. The inflorescence is terminal or axillary, and solitary or in spikes or panicles. The flowers are regular, united, and usually ephemeral.

The calyx is free, or only slightly adnate to the base of the germen; the sepals are two, seldom 3 or 5, and usually connate at the base. The petals are perigynous, exserted from the calyx or torus, and in number 5, but occasionally 3, 4, or 6; more or less coherent, and sometimes absent. The stamina are definite, exserted with the petals from the calyx or torus, variable in number and opposite the petals, or alternate with them, and often unsymmetrical. The filaments are discrete, and the anthers versatile and 2-celled, with a double longitudinal dehiscence. The germen is superior, 1-3 celled, and many-ovuled; the style single and filiform when present, and the stigmata several cleft.

The fruit is a 1-celled capsule, either dihiscing longitudinally or transversely, and many-seeded, sometimes indehiscent, and 1-seeded by abortion. The placenta is central, the seeds albuminous, not winged; the embryo curved round the farinaceous albumen, the cotyledons oblong, and the radicle round and long.

(3255.) Hence, differentially considered, the *Portulaceæ* are herbaceous or shrubby *Crassulinæ*, with a mostly disepalous calyx, few or no petals, when coherent forming a very short tube; stamens, when few, alternate with the sepals; the ovary 1-celled, the seeds wingless, and the embryo curved round the mealy albumen.

(3256.) *Portulaceæ*, thus restricted, form a much less extensive group than it used to be when its old latitudinarian definition included not only the contingent *Fouquieraceæ*, but also the *Knawels*, *Tamarisks*, &c., now forming distinct associations, and in obedience to their structural affinities transferred to other stations, [§ 1806.] But this type has gained more in precision than it has lost in extent, although its similitude to the *Scleranthaceæ* is so great, and its connexion with the *Dianthaceæ* so close, that were it possible, without violating other still more intimate relationships, it would be well to consociate the whole. The apetalous genera, as De Candolle observes, tend towards the apetalous *Mesembryanthidæ;* and those with indefinite stamens and hairy axillæ indicate an approach to the *Nopalaceæ* of the following section.

(3257.) The *Portulaceæ* are distributable into three subtypes, or rather three small modern groups, including *Portula*, *Telephium*, and *Polycarpæa*, with their respective allies; and hence called the *Portulidæ*, *Telephidæ*, and *Polycarpidæ*. The two latter are often associated with the *Scleranthaceæ*, and in many respects approach the *Dianthaceæ*, as the stamens occasionally become hypogynous, as those of the last-named type are sometimes perigynous in their exsertion.

(3258.) The *Portulidæ* are disepalous *Portulaceæ*, with stamina opposite the petals, and stipules none or membranaceous, and leaves opposite or alternate.

(3259.) The *Polycarpidæ* are penta-synsepalous *Portulaceæ*, with stamens opposite the sepals, opposite leaves and scarious stipules.

(3260.) The *Telephidæ* are penta-synsepalous *Portulaceæ*, with stamens opposite the sepals, scarious stipules, and alternate leaves.

(3261.) The *Portulaceæ* are all innoxious plants, possessed of very little either smell or taste, and not remarkable for any active properties. Their leaves are for the most part fleshy, and often edible. The common Purslane, (*Portulaca oleracea,*) is cultivated on the Continent as a dietetic vegetable, and esteemed, notwithstanding its insipidity, for the readiness with which it takes the flavor of more sapid viands. The seeds of Purslane are said to be anthelmintic, and they form an ingredient in Renaud's vermifuge powder. An unnamed species of Purslane is also said to be used in St. Domingo as a remedy against worms ; and the *Da-t-kai* of Caffraria, the roots of which are eatable, is a Purslane ; this *Da-t-kai,* however, must not be mistaken for the *Dacka* of the Hottentots, with the juice of which they form an intoxicating liquor. This latter is said to be the wild Hemp, which, according to La Harpe, they also smoke like tobacco. In the Isle of France, the leaves of *P. meridiana* are made into poultices for malignant ulcers, and those tumors the negroes are subject to which in the East Indies are called *todda vela,* and in the Antilles *Crabe.* Some species of *Claytonia,* as *C. Cubensis* and *perfoliata,* are also esculent, and are used as food in the same manner as Purslane.

(3262.) FOUQUIERACEÆ. *Fouquiera* and *Bronnia* have been separated from the *Portulaceæ,* and formed into the present type by De Candolle, because they deviate too widely, and in too many points, to be immediately associated with them. In the first place, their petals cohere and form a long tube, similar to that of the *synpetalous Crassulidæ.* 2dly. The capsule is 3-celled, with a loculicidal dehiscence and septiferous valves. And 3dly. The embryo is straight, placed in the centre of fleshy albumen, and the cotyledons are flat. Furthermore, the *Fouquieraceæ* are trees or shrubs, not herbaceous plants, with the fleshy leaves clustered in the axillæ of a spine or cushion ; the inflorescence is in terminal spikes or panicles, and the flowers are scarlet. In other circumstances they are accordant with the *Portulaceæ.*

(3263.) Hence, differentially considered, the *Fouquieraceæ* are synpetalous *Crassulinæ,* with a long corolline tube, a 3-celled loculicidal capsule, with septiferous valves, indefinite ovules, winged seeds, a straight embryo in the centre of fleshy albumen, and clustered leaves.

(3264.) The *Fouquieraceæ* are Mexican plants, the properties of which are as yet unknown.

(3265.) *Tamarix,* once included among the *Portulaceæ,* has been made the normal genus of a separate group, between which and the *Telephidæ* there is a relationship observable ; but its hypogynous stamens, exalbuminous comose seeds, and parietal placentæ, are obstacles to any close alliance with the *Portulaceæ,* and seem rather to indicate a connexion with the *Cistinæ.*

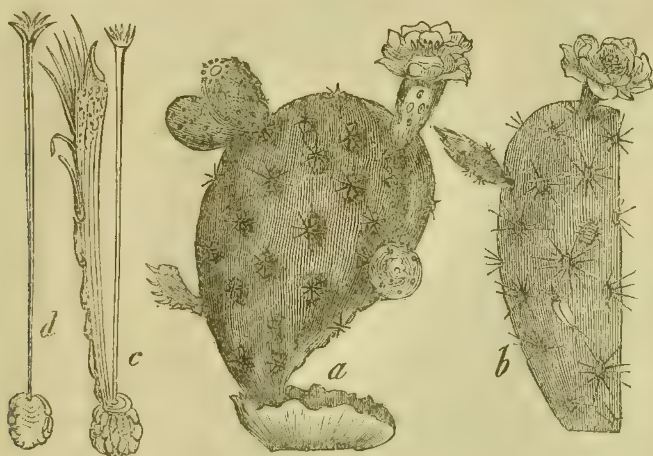
GROSSULINÆ.

(3266.) *Ribes Grossularia,* the gorse- or goose-berry, the latter being a corruption of the former word, which has reference to the gorse or furze-like prickles with which the plant is armed, gives

its specific or subgeneric name to the present section, as well as to one of the seven types it comprehends. And the *Nopal* or Indian-fig, the passion-flower, and four other genera of exotic and less familiar plants, called *Homalium*, *Samyda*, *Turnera*, and *Loasa*, designate the other six types respectively.

(3267.) The *Grossulinæ*, collectively considered, are perigynous *Rosales* or *Myrtosæ*, with the petals, when present, exserted from the faux of the calyx, the germen inferior, rarely free, symmetrical, and 1-celled, with parietal placentæ; seldom either 2-celled or with the placentæ central.

(3268.) Nopalaceæ. The *Cacti* or Indian-figs, form a type intermediate between the *Portulaceæ* of the preceding, and the *Grossulaceæ* of the present



(*a*) *Cactus or Opuntia Tuna.* Entire plant, to shew the succulent leafless stem, with tubercles, prickles, and flowers. (*b*) *C.* or *O. Cochinillifera*, with the cocci. (*c*) Section of the flower, to shew the inferior germen, style, and cleft stigmata, stamens and many-pieced perianth. (*d*) Pistil denuded of perianth and stamens.

section, with the latter of which they were formerly combined and to which they are nearly related, notwithstanding their dissimilarity in port.

(3269.) The *Nopalaceæ* are (with perhaps a single exception) shrubs, having succulent stems, very variable in form, either undivided or branched; angled, or 2-edged, foliaceous, but in general destitute of leaves. The leaves when present are smooth and fleshy; in general small and caducous, exstipulate and without cirrhi: but most frequently degenerating into tubercles and prickles, or superseded by them.

The inflorescence is solitary and sessile; and the flowers, which are usually shewy, are regular and united, and ephemeral, lasting only either a night or a day.

The calyx is superior, adnate to the germen, fleshy, and often prolonged beyond the ovary. The sepals are numerous, for the most part indefinite, and either crowning the germen or covering its whole surface; marcescent or deciduous, and so gradually becoming petaloid, that the calyx and corolla, both of which are imbricate in æstivation, are indistinguishable from each other. The petals are disposed in 2 or several series arising from the faux of the calyx, sometimes

irregular, and scarcely free, becoming like the sepals subconcrete by their claws. The stamens are indefinite, multiseriate, and more or less cohering with the sepals and the petals. The filaments are thin, (in Opuntia slightly irritable,) and the anthers 2-celled and subversatile, being terminal and yet oscillating; they dehisce by longitudinal chinks. The germen is inferior, ovate, fleshy, and 1-celled. The placentæ parietal and many-ovuled. The styles, equal in number to the trophosperms, are connected to form a solid or fistulous thread-like column, terminated by a cluster of stigmata equal in number to the styles and trophosperms; rarely connected so as to form a tubercle.

The fruit is a succulent, 1-celled, many-seeded, umbilicate berry, either smooth and crowned with the calyx, or covered with tubercles and invested with scales; the umbilicus is terminal.

The numerous seeds are at first attached by long funicles to parietal placentæ; subsequently they become loose, and are imbedded in a juicy pulp. In form they are oval or obovate, and without albumen. The embryo is either curved or spiral, seldom straight; the radicle is short, thick and obtuse, and the cotyledons variable: during germination they are in general thick and fleshy, but sometimes foliaceous; at others very small or obsolete, and perhaps, in *Mammillaria* and several aphyllous species, altogether absent.

(3270.) Hence, differentially considered, the *Nopalaceæ* are shrubby *Grossulinæ*, with succulent stems, numerous and indistinguishable sepals and petals, indefinite stamens, inferior germen, concrete carpella, unilocular polyspermous fruit, numerous placentæ, and exalbuminous seeds.

(3271.) The *Nopalaceæ* are distributable into two subtypes, the *Rhipsalidæ*, including the single but very distinct genus *Rhipsalis*; and the *Opuntidæ*, which comprehends all the genuine cacti formerly referred to a single genus, but now distinguished into six genera or subgeneric groups, called *Mammillaria, Melocactus, Echinocactus, Cereus, Opuntia,* and *Pereskia.*

(3272.) In the *Rhipsalidæ* the placentæ are central, and hence the ovules and seeds are central also:

(3273.) While, in the *Opuntidæ*, the placentæ or trophosperms are parietal, and hence the ovules and seeds are attached to the sides of the berry.

(3274.) *Rhipsalidæ.* The *Rhipsalides*, so called from their leafless procumbent branches being as flexible as those of willows, are curious epiphytic plants, growing on and hanging from trees in tropical countries. They are chiefly interesting from the circumstance of the placentæ being central, which, although an exception to the general character of the section, confirms the affinity of the *Crassulinæ* and *Grossulinæ*, and hence they may be esteemed the transitional grade that connects the two.

(3275.) *Opuntidæ.* The *Mammillariæ* are roundish or subcylindrical shrubs, with the stems so succulent and the parenchyma so much developed, that the ligneous axis is scarcely apparent. They are leafless, but the tubercles, as De Candolle observes, bear some similitude to the foliage of *Mesembryanthemum barbatum*, and hence are probably degenerate leaves. The seeds of the Mammillariæ are said to be acotyledonous; their stems are also lactescent, and the milky juice being sweet and pleasant, which is not frequently the case in lactescent plants, their generic name, *Dug-cactus*, is peculiarly appropriate, as well as some of the specific ones, though almost pleonasms, such as *M. magnimamma* and

parvimamma. In the *Euphorbiaceæ*, which, like the *Mammillariæ*, are succulent, leafless, and lactescent, the milk is acrid, and often poisonous. In the *Echinocacti* and *Cerei* the seeds are also said to be destitute of cotyledons; in the *Melocacti* they are small, but in the *Opuntiæ* and *Rhipsalides* they are well developed.

(3276.) The fleshy stems of all the *Cacti* are esculent, and in dry seasons the cattle in the West Indies resort to the rocks, and otherwise barren districts in which these plants abound, and tearing off the thorny teguments with which they are covered, feed upon the moist pulp within. The fruits of many species are also eatable; they are in general slightly acid, but have not much flavor; still their succulence renders them agreeable in warm climates.

Pliny tells us that the word *Opuntia* is derived from *Opuns*, the name of a town near Phocis in the vicinity of which the plant so called grew naturally in abundance. Sprengel asserts that our *Opuntia* is the *Opuntia* of Theophrastus; but other writers, without much reason, doubt their identity. [§ 3261.]

(3277.) *Opuntia vulgaris*, the common Indian fig, when eaten in any quantity, tinges the urine of a red colour, as beet-root does, but without producing any untoward effects. Its fruit is about the size of a hen's egg; the fruit of some species is as small as currants, while in others, such as *O. Tuna*, which is much esteemed in Chili, it is larger than in the *Opuntia vulgaris*.

(3278.) The *Cerei*, like the rest of the *Cacti*, are very ornamental plants, with elongated, and often flexible, thonglike stems and specious flowers. Some, as the *Cereastri*, stand erect like fluted or many-angled columns; others are pendent or creep along the ground like serpents, and hence their subgeneric name of *Serpentini;* and others again, as the *Alati* or *Phyllanthiöides* have their stems flattened to simulate leaves; or, as the *Opuntioides*, articulated and moniliform. The beauty of *C. speciocissimus* and *C. flagelliformis* has rendered them universal favorites; and, from being diurnal flowers, they are better known than the *C. grandiflorus* or *Night-blowing Cereus*, by which however they are far exceeded in splendour. The blossoms of this plant begin to expand about 6 or 7 o'clock in the evening, are fully blown about midnight; and, before the cock crows, that is, by 3 or 4 in the morning, they are quite decayed. But during its short continuance, there is scarcely any flower known of greater beauty. The calyx, when open, measures nearly a foot in diameter, so that this magnificent blossom is almost three feet in circumference. The outer sepals, and especially their external faces, are of a dark-brown colour; the inner ones of a splendid yellow, gradually shaded into the petals, which are of a pure and brilliant white; and the centre of the flower is filled by the numerous recurved stamens that surround the style. So that when 6 or 8, or 10 flowers, as is often the case, are open at once on one plant, they make indeed a glorious appearance, resembling so many stars shining in all their lustre; verifying the poet's declaration that

> "Darkness shews us worlds of light,
> We never see by day."

Besides their beauty, these flowers are delightfully fragrant, and fill the air with odours to a considerable distance round.

(3279.) The fruit of *C. sepium*, which grows to profusion in the districts at the foot of Chimborazo, is there used by the natives as a remedy in bilious fevers.

(3280.) *Pereskia aculeata*, which is a pleasant eatable fruit, about the size of a small plum, is called in the West Indies the Barbadoes gooseberry; and the

Cacti in general may be considered the representatives of our Grossulariæ in warm climates, which are as unfavourable to their growth and the development of their fruit, as the colder parts of the temperate regions are to the Nopalaceæ. The gooseberry degenerates even in France and Spain. *P. Bleo* is employed in South America for the purpose of purifying water.

(3281.) Several species of *Cactus* are infested with insects belonging to the genus *Coccus*, some of which, especially the *Coccus Cacti*, become, from the colouring matter they collect from the fruit and flowers of the *Cacti*, of vast commercial importance; being, in fact, the cochineal of the painter and the dyer. Several of the *Cocci* have already been mentioned as affording either mediately or immediately valuable dyes; such, for examples, as the *Coccus Ilicis*, which abounds on the *Q. coccifera*, whence *Kermes*, and of old all the best *kermesine*, or crimson colours, were procured; *C. Lacca*, which yields the lake or lac dyes, gum lac, &c.; *C. Polonicus*, which is found on the roots of Scleranthus perennis, and other plants, and from which a crimson dye can be also made; and *C. mannifer*, which punctures the *Celastrus ceriferus*, being thus the proximate cause of the exudation of the waxy matters found on that tree, from which, in China, candles are made. But these are all of far less value than the *Coccus Cacti* or Cochineal; and of this species none afford, or rather collect, so fine a pigment as those which feed on the *Cactus*, hence called *Cochinillifera*. [§ 3261, *b*.] The delicate red juice of the fruit of this Cactus is the appropriate food of these insects, and the brilliancy of their colour diminishes when they are fed upon other species. The *Cocci* being hence the collectors of this colouring matter, the pureness of which is deteriorated by their exuviæ being blended with it, for the whole of the insect is dried and powdered, it has been attempted to collect and inspissate the fruit-juice alone, and thus to avoid the admixture of the exuviæ of the Coccus; but whether from the juices undergoing some change by animal digestion, or otherwise, the scheme has not been hitherto successful.

The fruit of *O. cochinillifera* is eatable; it is mildly astringent, and is reported to be a powerful diuretic, tinging the renal excretions of a red colour.

(3282.) The *Cacti* are remarkable, like many other very succulent plants, such as the *Mesembryanthidæ*, *Crassulidæ*, some of the *Euphorbiæ*, &c. for luxuriating in the hottest, driest, and most sterile situations. Such as sandy deserts, in the crevices of rocks, on the tops of walls, roofs of houses, and so forth. For such localities they are fitted by nature by the peculiar structure of their cuticle, which will rapidly absorb moisture, but perspires tardily. De Candolle has shewn that the cuticle of the *Cacti* is very scantily supplied with evaporating pores; and hence their endurance of excessive heat in dry soils without exsiccation; to this also may be attributed the succulence of their stems. That this hypertrophy, which is the normal condition of various plants, may be artificially produced in numerous others which are naturally dry and almost destitute of pulp, horticulture affords abundant proof; and therefore it is obvious, that although an analogy exists between the *Nopalaceæ* as well as the *Crassulinæ*, and some of the *Euphorbiaceæ*, *Asclepiadeæ*, and even *Asphodelaceæ*, still that no real affinity could be established merely on this similitude in the organs of vegetation.

(3283.) Grossulaceæ. The genus *Ribes*, including the gooseberries and currants, formerly associated with the *Nopalaceæ*, but now separated to form the present type, has, like its old congener *Cactus*, been distributed into several genera

or subgeneric groups; such as *Grossulariæ*, the true gooseberries; and *Ribesiæ*, the true currants; to which may be added *Robsonia*, a plant allied to the former; and *Symphocalyx*, a sub-genus, appended to the latter group. These subgenera are convenient demarcations of the various groups of species, but their differences are not sufficient for them to be considered as generically distinct; and even as it is, their differential characters are still unsettled. Perhaps the simplest plan is to

Ribes [*Grossularia*] *Uva-crispa*.

A Branch with leaves aculei, and fruit.

(*a*) Sprig with flowers.

(*b*) Flower opened to shew the pentasynsepalous calyx and definite perigynous petals and stamens.

(*c*) Pistil to shew the inferior germen.

(*d*) Transverse section of the berry.

(*e*) Longitudinal section of ditto, both shewing the two parietal placenta, the bracteolæ on the pedicels, and marcescent calyx.

(*f*) Seed with its long podosperru and arillus.

(*g*) Seed denuded of the arillus.

(*h*) Section of the seed to shew the embryo.

(*i*) The embryo.

consider all the aculeate species to belong either to *Robsonia* or *Grossularia*; and those which are unarmed to *Ribesia* or *Symphocalyx*; the former two are interdistinguished by the first having the flowers tetrandrous, the red calyx cylindrical, and the stamens twice as long as the sepals; while the second or true gooseberries have the flowers pentandrous, and the calyx campanulate. The latter two are in like manner distinguished by having in the *Ribesiæ* or true currants, the racemes many-flowered, and the cylindrical or campanulate calyx not yellow, while in the *Symphocalyces* the calyx is tubular and of a fine yellow colour.

(3284.) The *Grossulaceæ*, thus formed of the Linnean genus *Ribes*, are, collectively considered, unarmed or aculeate shrubs, with round or irregularly angled ligneous stems and branches; simple, lobed, alternate leaves, plaited in vernation, sometimes furnished with small glands, and caniculate or ciliate petioles, but destitute of cirrhi and stipules.

The inflorescence is axillary and racemose. The racemes sometimes becoming sertula, and the flowers are mostly of a greenish white, sometimes yellow or red, and united, rarely separate by abortion. The pedicels are exarticulate, and furnished with bracteolæ.

The tube of the calyx is adnate to the limb, is 4-5 cleft, regular, often coloured, marcescent, the sepals being few and imbricate in æstivation. The petals are definite [5-4 or 0] perigynous, exserted from the faux of the calyx, and alternate with its lobes; subunguiculate and marcescent like the sepals. The stamina are perigynous, equal, definite, [4-5, seldom 6], exserted between the petals and opposite the sepals; the filaments are thread-like or awl-shaped and free; the anthers are small, 2-celled, and in general burst internally and lengthwise by clefts: (in one variety of the red currant the dehiscence is lateral and transverse.) The germen is inferior or half inferior, 1-celled, with 2 parietal placentæ, bearing many ovules. The style is single, formed of the two connate carpels, and 2 or more cleft.

The fruit is a subglobose berry crowned with the marcescent calyx, 1-celled, many-seeded and indehiscent. The placentæ are nerviform, opposite and parietal. The seeds indefinite, horizontal, and suspended by long threadlike podosperms, until they are detached and rest on the juicy pulp. The testa is gelatinous, and the podosperm expanded into a chalaza. The albumen is horny (?) whitish, and of the same shape as the seed, the embryo is very small, situated at the narrow end or base of the seed; the radicle obtuse, excentric, and turned towards the hilum; and the cotyledons foliaceous during germination.

(3285.) Hence, differentially considered, the *Grossulaceæ* are shrubby, non-succulent *Myrtosæ*, with distinct and definite sepals, petals, stamens and placentæ; the former three, being usually each five in number, never more than six; and the latter only two.

(3286.) Of the *Grossulariæ*, or aculeate *Ribes*, there are fifteen or sixteen known species, the fruits of all which are eatable, but the varieties of *R. Uva-crispa* are the most valued, and those in most general culture: the rough and smooth gooseberries [*G. sylvestris* and *sativa*] considered the two chief varieties of *Ribes* or *Grossularia Uva-crispa*, are often esteemed distinct species; the former being the *R. Grossularia*, and the latter the *R. Uva-crispa* of Linneus. De Candolle, however, believes them to be specifically the same.

In England gooseberries are much cultivated, especially in Lancashire, where, from prizes being offered by the Provincial Horticultural Societies, berries have been produced, each weighing an ounce or an ounce and a half. Gooseberries, although grown, are not very common in the gardens either of Southern or Northern Europe, the heat of the summers in Spain and Italy being too great, and in Norway and Sweden the seasons are too rapid for the full development of the fruit. In England gooseberries are much esteemed both as a dessert and kitchen fruit; and, from the facility with which when in an unripe state they can be preserved throughout the year in bottles from which the air has been excluded by boiling, renders them very serviceable as a winter fruit. Gooseberries also, when preserved with sugar, make very good jams and jellies; and, when fermented, an excellent wine is produced, which sparkles when the cork is drawn, and is known as English champagne.

The pleasant acidulous flavour of the gooseberry depends upon the presence of malic acid blended with sugar; and upon the varied proportions in which these two principles are developed depends the fitness of the several varieties for dessert or kitchen use, for preserving, or for making wine.

(3287.) *Pectic acid*, the *vegetable jelly* of the older chemists, which is remark-

able for forming a gelatinous coagulum when mixed with water, abounds in the gooseberry, and hence by *Guibourt* it was once called *Grossuline*; but, as it is common to many other plants, such as carrots, turnips, parsnips, beet, &c. perhaps Braconnot's name is the preferable one. Pectic acid is reputed to be one of the most efficient antidotes in cases of poisoning by the salts of lead, copper, antimony, zinc, and quicksilver, with the exception of tartar emetic and corrosive sublimate; and hence gooseberries and gooseberry-jelly become domestic resources in cases of such accidents, until medical assistance can be obtained. The Pectic acid has a double advantage, for it not only by its chemical action neutralizes the poisonous substances, but by its mucilaginous nature involves their particles, and renders them mechanically inert.

(3288.) From their resemblance to small unripe figs, the *grossi* of the ancients, gooseberries were called *grossulariæ* by the Latins, and *groseilles* by the French; and hence, perhaps, our gooseberry is a corruption of *gross-berry*, notwithstanding the opinion entertained by some that it is a degeneration of *gorse-berry*. [3266.] Our word currant, the *groseilles en grappes* of the French, and *uvetta* of the Italians, has evidently a reference to the similitude of the fruit to the *corinths* or *currants* of commerce, which are the grapes of Zante.

(3289.) The red and white, the variegated and flesh-coloured currants of our gardens, are all varieties of *Ribes* (or *Ribesia*) rubrum, which is itself, in all probability, only an improvement of *R. sylvestre*.

(3290.) Currants, like gooseberries, owe their pleasant flavour to the sugar and malic acid they contain, and, like them, they are much esteemed for dessert, and making tarts, wine, preserves, &c. When fresh they are refrigerant, and very grateful to the parched palates of persons suffering from fever. Equal quantities of sugar and red currant juice make an excellent jelly, very much in request as a sweet sauce to eat with hare, venison, and mutton, as well as various articles of confectionary and in medicine. But their several domestic uses are too well known to be dwelt on.

(3291.) The *black currant* is a distinct species, of which no varieties have hitherto been produced. The leaves and flowers of this plant are covered with glands, that secrete the peculiar odour for which it is remarkable. Few persons like either the taste or smell of the black currant so well as the red; and it is therefore less cultivated as food, but its fruit makes a jelly or jam that is used in domestic medicine as a remedy in cases of hoarseness or sore throat; and lozenges made from the fruit, especially from the skins, are of much service in pectoral complaints. In Russia, where the black currant grows wild, the berries are made into wine, the juice being fermented either alone or with honey, a little spirit being also sometimes added. In Siberia a drink is made of the leaves, and they are often dried and mixed with souchong, to give it the flavour of green tea; they are also used to tincture colourless spirit, so as to make it resemble common brandy.

The fruit, leaves, and wood of the black currant are tonic, and stimulant; and some of the other species, the taste of which is mawkish, are said to be emetic; but they are not used in medicine.

(3292.) SAMYDACEÆ. *Samyda* and its allies, associated to form this type, are tropical trees or shrubs, with alternate, sometimes subdistichous, simple leaves, which are coriaceous, evergreen, and furnished in general with round or oblong pellucid dots, short petioles, and small free deciduous stipules. The inflorescence

is axillary, either solitary or fasciculate, the pedicles articulate, and the flowers united.

The calyx is free, 3-5-7 sepaled, the sepals more or less coherent by their ungues, usually petaloid within, and subimbricate, or rarely valvate in æstivation. The corolla is absent or reduced to a thin torus that lines the bottom of the calyx. The stamens are definite, 2-3 or 4 times as many as the sepals, and exserted from the calyx; the filaments are monadelphous and subulate, either all antheriferous, or alternately fertile and barren, the shorter being villous or ciliated; the longer ones bearing 2-celled erect antheræ that dehisce lengthwise. The germen is free or superior, 1-celled, with parietal placentæ, and many ovules. The style is filiform, and the stigma either capitate or slightly lobed.

The fruit is a coriaceous 1-celled capsule, with 3-5 valves, often pulpy within and slightly coloured, and dehiscing imperfectly from the apices of the valves. The seeds are indefinite, attached to the valves, and included within a fleshy arillus; they are oval in shape, with an excavated hilum. The albumen is fleshy and oily, the embryo small and inverted, the radicle obtuse and turned away from the hilum, and the cotyledons ovate, foliaceous, and plicate.

(3293.) Hence, differentially considered, the *Samydaceæ* are apetalous subpetaloid *Grossulinæ*, with superior germen, definite (3-5) parietal placentæ; dehiscent, many-seeded capsules, monadelphous stamens, and punctate leaves, the dots being round and oblong.

(3294.) The bark and leaves of the *Samydæ* are said to be slightly astringent; and the leaves of *Casearia ulmifolia* when boiled, are applied in Brazil to wounds, and are there reputed an antidote to the bites of poisonous serpents.

(3295.) Homaliaceæ. *Homalium*, *Aristotelia*, and their typical allies, are tropical shrubs or small trees, with simple, entire, alternate, impunctate leaves, and free deciduous stipules.

The inflorescence is spicate, racemose, or paniculate, the pedicels ebracteate, and the flowers regular and united.

The calyx is free, often adherent at the lower part to the germen, the sepals connate, forming a funnel-shaped tube with a 5-15-cleft persistent limb, herbaceous in texture, and subvalvate in æstivation. The petals are scarcely distinguishable from the sepals, but the alternate segments of the calyx being petaloid are considered as the corolla. The torus is expanded into a thin plate lining the calyx; and there are glands or scales, either single or in pairs, situate at the base of the sepals. The stamina are perigynous, exserted from the calyx alternate with the glands, and therefore opposite the petals and alternate with the sepals, occasionally solitary, but generally in groups of threes or sixes. The filaments are free and subulate, the anthers incumbent, 2-celled, the locules distinct both above and below, and bursting lengthwise. The germen is half-inferior, 1-celled, with 3-5 parietal placentæ, and 1-2 or many ovules. The styles are 3-5, simple, filiform or subulate, free, (rarely connate,) and the stigmata are undivided.

The fruit is capsular or sub-baccate, 1-celled, the placentæ filiform and parietal. The seeds small, ovate, or angular, and solitary or numerous. The albumen is fleshy, and the embryo included.

(3296.) Hence, differentially considered, the *Homaliaceæ* are sub-corollaceous *Grossulinæ*, with glandular or scaly nectaries, a half-inferior ovarium, definite (3-5) placentæ, and impunctate leaves.

(3297.) The *Homaliaceæ* seem to be transitional from the *Samydaceæ* to the

Passifloraceæ, for their doubtful corolla is intermediate between the petaloid inner surface of the calyx in the former, and the undistinguishable sepals and petals of the latter. In *Napimoga* also there are no glands at the base of the sepals, thus tending in this particular to the *Samydaceæ*, as the ovarium, which is said to be superior in *Astranthus*, does towards the free germen of the *Passifloraceæ*.

The questionable nature of the perianth has induced both Brown and De Candolle to consider these plants as apetalous, but the latter classes them with his Dichlamydeæ, and puts them near the *Chailletiaceæ* [§ 1578], which, like them, are doubtfully referred either to the mono- or dichlamydeous groups.

(3298.) Little is known of the general properties of the *Homaliaceæ*. *Aristotelia Macqui* is the *Macqui* of Chili, the berries of which are eatable; they are about the size of peas, of a very dark purple colour, becoming ultimately black, and of an agreeably acid flavour. The native Chilians make a wine of their juice, and in a fresh state they are esteemed as a febrifuge, and reputed to be very serviceable in malignant fevers. The bark is astringent and contains so much gallic acid that it blackens rapidly the instruments with which it is cut. This is the plant which Dombey used with such remarkable success against the plague, in Chili, in the year 1782.

(3299.) Passifloraceæ. The passion-flowers, and their immediate allies associated to form this type, are herbaceous or shrubby plants, rarely trees, with often twining scandent stems, and alternate, simple, petiolate leaves, either entire or lobed, and usually furnished with glands and stipules.

The inflorescence is axillary, and the peduncles, which in the non-scandent species are all floriferous, become in part in the climbing ones converted into tendrils. The flowers are shewy, regular, and united, rarely separated by abortion, usually solitary, seldom aggregate, and for the most part invested with a triphyllous involucrum.

The calyx is free, the sepals 5-10, the external ones herbaceous, and the inner petaloid; they are imbricate in æstivation, sometimes irregular, cohere by their ungues, and constitute a tube of variable length, which is lined by filamentous or annular processes, forming a nectary. The petals when present are 5 in number, and exserted from the faux of the calyx external to the ring of filaments; often scarcely or not at all distinguishable from the sepals, and occasionally absent or metamorphosed into the filamentous nectary. The torus lines the bottom of the calyx, and is produced to form a cylindrical column which bears the germen, and from which the stamens are exserted. The stamina are definite (5), in *Smeathmannia* alone indefinite, surrounded by numerous barren filaments, forming a radiant circle, arranged in one or two series, thus accounting for the indefinite stamens of Smeathmannia. The filaments are shortly monadelphous, and opposite the external lobes of the calyx. The anthers versatile, or rather peltate, being attached to the filaments by their back; reversed, and thus by situation extrorse, although in reality introrse, 2-celled, and dehiscent lengthwise. The germen is free, stipitate, 1-celled, with 3, rarely 5, parietal placentæ, and many ovules. The styles are short or none, and the stigmata are equal in number to the trophosperms, thick and lobed, or dilated.

The fruit is baccate or capsular, either naked or invested by the calyx, and elevated on the stalk-like torus. It is 3- rarely 5- valved, 1-celled, when capsular dehiscent by valves, when baccate indehiscent; the parietal placentæ (3-5 in

number,) are polyspermous, nerviform, and attached to the middle of the valves. The seeds are pendulous, rarely erect, and covered either by a membranous or pulpy arillus (seldom exarillate), the testa is crustaceous, and the tegmen membranaceous. The albumen is fleshy but thin, and often scrobiculate; the embryo is straight and included, the radicle round and turned towards the hilum, and the cotyledons flat and foliaceous, seldom fleshy.

(3300.) Hence, selecting the chief differential characters, the *Passifloraceæ* are subcorollaceous *Grossulinæ*, with radiant nectaries, a stipitiform staminiferous torus; definite, many-seeded, placentæ; and scrobiculate albumen.

(3301.) Considerable variations of development occur among the *Passifloraceæ;* and these are considered indicative of the three subtypes sometimes separated from each other, but here associated together, and which, from *Paropsia*, *Passiflora*, and *Malesherbia*, are called the *Paropsidæ*, *Passifloridæ*, and *Malesherbidæ*.

(3302.) The *Paropsidæ* are pentapetalous *Passifloraceæ*, with subsessile ovaries, and non-scandent stems, destitute of tendrils.

(3303.) In the *Passifloridæ* the petals are none or indeterminable, the ovary stipitate, and the stems often scandent and cirrhose.

(3304.) In the *Malesherbidæ* the corolla is pentapetalous, the petals convolute in æstivation, the nectary annular, the styles long and exserted from distinct points of the ovary; the ovules erect, the seeds exarillate, and the cotyledons fleshy. They are likewise non-scandent undershrubs with exstipulate leaves, and destitute of cirrhi.

(3305.) These three subtypes form an interesting series of gradations from the preceding to the succeeding groups. *Smeathmannia* of the *Paropsidæ* has indefinite stamens like the *Nopalaceæ*, and in many respects is connected to the *Homaliaceæ;* the doubtful and variable nature of the perianth in *Passifloridæ* is similar to that of the *Samydaceæ* and *Homaliaceæ;* and the *Malesherbidæ*, by their exarillate seeds, twisted petals, and the exsertion of their styles, and habit, prepare the way for the *Turneraceæ*, which follow. De Candolle also well observes that the staminiferous stipitate torus of the *Passifloridæ* supporting the germen, renders the type intermediate between the thalamiflorous *Rhœadosæ* and the perigynous *Myrtosæ*, for the stamens are neither calyciflorous nor thalamiflorous, and almost as much hypogynous as perigynous in their exsertion.

(3306.) The *Passifloraceæ*, although in general innoxious, are suspicious plants; for one species, the *Passiflora quadrangularis*, is known to be deleterious, and the others have not been sufficiently examined to allow their innocence to be affirmed, notwithstanding the fruit of most of them, even of the noxious one, is eatable. The quadrangular passion-flower, which is a native of the Isle of France, is cultivated in several of the French settlements for the sake of its root, which is affirmed to be a most powerful narcotic. It is said to owe its activity to a peculiar principle that the French chemists have called *Passiflorine;* and M. Ricord-Madiana, who has published an essay on the subject, reports that a decoction of the root killed a dog to whom it was given, in forty minutes: as soon as the animal took it, he fell on his side as if struck down by apoplexy; and, on examination, the heart and the vessels of the brain were found gorged with black blood. Fowls, when forced to swallow this decoction, became cataleptic; and lizards remained in a state of stupor for several hours after its administration.

The activity of this root seems to be lessened and destroyed by time, for some that had been kept three years was found on experiment to be inert.

M. Ricord adds that the Peteveria fetida is reputed in the Antilles to be an antidote to this poison, and that the fruit, which is there eaten, is large and good, often weighing as much as 6 lbs.

(3307.) *P. maliformis* is the sweet calabash of the West Indies, where it is much esteemed as a dessert; and the fruit of *P. alata, coccinea, edulis, laurifolia, ligularis, ornata, tinifolia,* and *cærulea,* are all likewise esculent. The part which is eaten is either the fleshy arillus or the juicy pulp that surrounds the seeds. This succulent matter is fragrant and cooling, and has a pleasant flavour. It is usually sucked through a hole made in the rind.

(3308.) *P. fetida,* like many other offensive plants, is esteemed as an emmenagogue; and is thought to be serviceable in hysteria; the infusion of the flowers is also taken as a pectoral medicine.

(3309.) The fruit of *P. laurifolia* is said to be aperient and diuretic; and the roots of *P. normalis* and *P. Contrayerva* are reputed to be as sure alexipharmics and carminatives as those of the *Dorsteniæ.*

(3310.) The name passion-flower owes its origin to some imaginative Jesuit, who fancied he had found an allegorical representation of our Saviour's

Passiflora cærulea. Cuttings to shew leaf, tendril, bracteæ, and flowers: the perianth consisting of many pieces varying in appearance from sepals to petals; the radiant nectary, the columnar disk bearing the stamens and pistil, which are figured separately as well as *in situ,* and the fruit.

passion, or at least, of the instruments of torture, as well as other attendant circumstances, in the structure of the blossoms, leaves, and tendrils of these curious plants.

(3311.) The passion-flowers are not only curious but most beautiful plants; they grow well and blossom freely in this country, yet they seldom ripen their fruit. Several hybrid varieties have beén produced by art, which exceed in beauty any of the natural species.

(3312.) The *Murucujæ,* once included in the genus *Passiflora,* but now considered as generically distinct, have, like them, esculent fruits, which are fragrant

and refreshing. Their leaves in decoction are esteemed (especially those of *M. ocellata,*) in the Antilles as an efficacious wash in diseases of the skin: and when taken internally they are reputed to possess anthelmintic powers.

(3313.) TURNERACEÆ. *Turnera* and *Piriqueta,* two genera formerly confounded with the *Portulaceæ* and *Cistaceæ,* have been separated from their old associations, and combined to form the present type. They are tropical herbaceous plants, with a tendency to become suffrutescent, and covered with a soft down or hairs, but destitute of stings. Their leaves are simple, entire (rarely pinnatifid) petiolate, often with two glands at the end of the petiole, and without either stipules or cirrhi.

The inflorescence is axillary and solitary, the peduncle either free or cohering with the petiole, articulate, and furnished with 2 bracteæ. The flowers are regular and united, generally of a yellow colour, rarely blue.

The calyx is free, and consists of 5 sepals, concrete by their lower halves, forming a cylindrical or funnel-shaped tube with equal pointed lobes, imbricate in æstivation, persistent, and often coloured. The torus is a thin plate lining the base of the calyx. The petals are 5, free, equal, and deciduous, exserted from the tube of the calyx, alternate with its lobes, and contorted in æstivation. The stamens are 5, perigynous, exserted from the tube of the calyx below the petals, alternate with them, and shorter. The filaments are free, the anthers erect, oblong, and 2-celled, with an introrse longitudinal dehiscence by a double chink. The ovarium is superior, 1-celled, with 3 parietal placentæ and many ovules; the styles are 3-6, more or less coherent, and either bipartite or multifid at their summits.

The fruit is a 3-valved, 1-celled capsule, with filiform placentæ on the axes of the valves, and dehiscent longitudinally from the apex to about half-way down the capsule. The seeds are indefinite, subsessile, and pendulous, with a thin membranaceous unilateral arillus and reticulated coriaceous testa. The albumen is fleshy, the embryo slightly curved, axile, spathulate, with the radicle turned towards the hilum, and the cotyledons somewhat plano-convex, entire, and foliaceous during germination.

(3314.) Hence, differentially considered, the *Turneraceæ* are exstipulate excirrhose pubescent *Grossulinæ,* with contorted petals, definite stamens, a free 3-valved capsule, 3 parietal placentæ, and subincurved embryo in the axis of fleshy albumen.

(3315.) *Turnera* was named after Dr. William Turner, of York, who published "A New Herbal" in 1551, in which there is much curious information. But none of the species of this or the allied genus are known to possess any active properties, neither have they been hitherto applied to any useful purpose. They are plants with the habit of Cistus, with inconspicuous yellow flowers, and of little beauty. They are hence chiefly interesting for the relations which their structure establishes and confirms between other groups. Thus in habit they sometimes agree with the cisti and sometimes with the mallows; and in the structure of the fruit they approach very near to the *Cistaceæ.* But the perigynous stamens remove them from immediate connexion with these groups, and bring them near the *Loasaceæ* and *Passifloraceæ,* leading thus on to the *Cucurbitaceæ* of the following section.

(3316.) LOASACEÆ. *Loasa* and its typical allies are American herbs, with

often scandent stems and cirrhi, more or less hispid, and frequently furnished with stings. The leaves are opposite or alternate, exstipulate and simple, but often variously lobed and cut.

Loasa grandiflora.

c. Cutting to show leaves, flowers, &c.

(a) A fifth part of the torus, with the inner scale like petals, and the barren filaments.

(b) The fruit to show the half-adherent calyx, and one of the persistent lobes left.

(c) Section of the fruit to show the 3-parietal placentæ, (*c*) seed.

(d) Section of ditto, to show the embryo in the axis of the albumen.

(e) Longitudinal section to show the same.

(f) The embryo removed.

The inflorescence is axillary, terminal, or lateral, and the peduncles 1-flowered. The flowers are large and elegant, regular and united.

The tube of the calyx is adnate to the germen, or closely invests it. The limb is 5 (seldom 4) cleft and persistent, and the petals 5-10, are exserted from the faux of the calyx, and are either all similar, or some of them are degenerate and scale-like, and in general subvalvate, rarely contorted in æstivation. The stamens are indefinite, multiseriate, free, or slightly connected by the bases of the filaments into bundles, and exserted with the petals, the outer rows being often barren. The filaments are subulate and unequal, and the anthers small, 2-celled, and dehiscent lengthwise. The ovarium is inferior, or included within the calyx when not wholly adherent to it; 1-celled, with 3-parietal placentæ and few or many ovules, the style is single, but composed of several (3-5-7) either wholly connate, or free only towards the summits.

The fruit is a capsule, either dry or subsucculent, inferior or half superior, and crowned with the persistent calyx. It is 1-celled, 3-5-7-valved, with thick parietal placentæ attached to the sutures; but sometimes with incomplete dissepiments, or rarely with a free central trophosperm. The seeds are pendulous, subsessile, mostly indefinite (few only in *Klaprothia* and *Mentzelia*,) and exarillate. The albumen is fleshy, the embryo straight, linear, oblong and axile, or included in the centre of the albumen; the radicle is turned towards the hilum, and the cotyledons flat and small, and foliaceous in germination.

(3317.) Hence, differentially considered, the *Loasaceæ* are apopetalous *Grossu-*

linæ with indefinite stamens, partly sterile, adnate or girding calyx, and 3-7 sutural or inter-valvular trophosperms.

(3318.) The *Loasæ* are chiefly prized for their beautiful and highly curious flowers. They are also remarkable for the admirable mechanism of their stimuli, and the acrimony of the poisonous fluid, these instruments instil into the wounds they make. The *Pumaysanca* of Brazil is a medicinal preparation of *L. punicea*, but of its uses, or of the properties of these plants in general, there is very little known.

The stings of the *Loasæ* resemble in some measure those of the *Urticæ*, but they have no other characters common, and this type is more nearly related to the *Passifloraceæ*, with some of which the included genera accord in habit, and especially to the *Cucurbitaceæ*, from which, however, they are in general distinguished by their apopetalous corollæ.

CUCURBITINÆ.

(3319.) The *Gourd* and the *Papaw* are typical of two natural groups of plants once united, but now, on account of their essential differences in structure, very properly distinguished from each other, and named the *Cucurbitaceæ* and *Papayaceæ* respectively. These associated types are nearly related to the *Grossulinæ*, especially to the *Passifloraceæ* and *Loasaceæ*. They, however, at the same time for the most part differ not only from the preceding section, but even from the whole suborder, by the cohesion of their petals. This deviation, from the most general collective sign, has, however, already been anticipated in several instances; yet here the union is so constant and so complete, that the apopetalous corolla is superseded by the synpetalous form, and that character becomes the exception which has hitherto been regarded as the general rule. This anticipation of the normal structure of the *Syringales* renders the systematic location of these two types debateable. Were strict reference had to the conventional collective character alone, the *Papayaceæ*, and the majority of the *Cucurbitaceæ*, should certainly be transferred from this order to the next; but, as they cannot be disjoined, and the nearest associates of the *Cucurbitaceæ* are the *Passifloraceæ* and *Loasaceæ*, it seems most advisable to retain them in the vicinity of the *Grossulinæ*, although not to include them, as Bartling has done, in the same section. Their relationship to the *Syringales* appears likewise to be sufficiently regarded by their proximity as border types, thus placed on the confines or neutral ground of either order; and, as the natural system is a system of affinities, these double alliances,

which distract an artificial analytic index, confirm and establish a natural synthetic scheme.

(3320.) Selecting the chief differential characters, the *Cucurbitinæ* are amphi- or syn-petalous ROSARES, with mostly separated flowers, 1-celled ovaries and parietal placentæ.

(3321.) CUCURBITACEÆ. The *Gourds* and their typical allies are annual or perennial herbaceous [or suffruticose ?] plants, with tuberous or fibrous roots and often striated stems, climbing by means of tendrils ; the leaves are alternate, simple, palmate, or quincuncially ribbed, succulent and covered with asperities, petiolate and exstipulate, the stipules being converted into lateral tendrils, or the tendrils, when axillary, being formed of abortive peduncles.

The inflorescence is axillary, and either solitary, fasciculate, or paniculate, and with scarcely ever any bracteæ. The peduncles are exarticulate ; the flowers white, red, or yellow, either monœcious or diœcious, but very rarely united.

Momordica Elaterium.

B. Cutting with leaves, stamineous and pistilline flowers and fruit.

(*a*) Pistilline flower separate, to shew the inferior germen.

(*b*) Section of the germen, to shew the adnate tube of the calyx, and the parietal, many-ovuled placentæ.

(*c*) Transverse section of the fruit, shewing the union of the 3-connate carpels, and the parietal placentæ.

(*d*) Fruit entire, crowned by the persistent limb of the perianth.

The calyx is penta-synsepalous, its tube adnate to the germen, and the limb 5-cleft or toothed, deciduous, and imbricate in æstivation; sometimes obsolete. The corolla consists of five petals, exserted from the faux of the calyx, or the edge of the torus, and alternate with the sepals : they are often intimately blended with the calyx, and scarcely distinguishable irom it, being apparently sub-continuous. They are more or less discrete or connate by their bases, but most commonly united: very cellular in their structure, strongly marked by reticulated veins, generally entire, but occasionally fringed at their edges. The stamina are definite (5) either free, or more frequently triadelphous, the filaments being connate in pairs, the fifth one remaining free ; or sometimes diadelphous by its union.

The filaments are seldom hairy. The anthers either free or connate, 2-celled, very long and sinuous, seldom short, and oval, having a conspicuous connectivum, continuous with the filament, and occasionally prolonged beyond the cells, which dehisce longitudinally by clefts.

The germen is inferior, 1-celled, with 3 parietal placentæ, and many ovules: sometimes subtrilocular or imperfectly 6-celled. The style is short or almost absent, and the stigmata (3-5) 2-lobed, very thick and velvety, or fringed.

The carpels (3-5, rarely by abortion 1,) are fleshy, connate, and invested by the torus and tube of the calyx, so as to form that kind of fruit denominated a pepo. This fruit is 1 celled with parietal placentæ, or 3-6 celled with the angular trophosperms forming a central column or triangular space. The podosperms are tumid towards the seeds, and form arilli, which are either succulent, or by exsiccation membranaceous. The seeds are flat and ovate, with coriaceous testæ thickened at the margins by the raphe, which is evident beneath the spermoderm, and the ends often become 2-3 lobed on drying. The embryo is straight and exalbuminous, the radicle next the hilum, which is oblique and at the apex of the seed, and the cotyledons are foliaceous and palmatinerved.

(3322.) Hence, differentially considered, the *Cucurbitaceæ* are amphi-petalous *Rosares*, or *Cucurbitinæ*, with inferior ovaries, and exalbuminous seeds.

(3323.) The genera here associated are distributed by De Candolle into two subtypes called *Feuillidæ*, [or Nhandirobeæ,] and *Cucumidæ* [or Cucurbiteæ].

(3324.) In the *Feuillidæ* the tendrils are axillary and peduncular, and the flowers diœcious.

(3325.) In the *Cucumidæ* the tendrils are lateral and stipular, and the flowers either diœcious, monœcious, or united.

(3326.) *Feuillidæ.* *Feuillea scandens* is the celebrated *Nhandirhoba* or *Ghandirhoba*, of South America, there held in so much repute as an antidote to various poisons, animal and vegetable. The natives employ it not only against serpent bites, but also to counteract the baneful effects of the Manihot and Manchineel. M. Drapiez likewise, after having expressly made experiments to ascertain its powers, states that animals poisoned with *hemlock*, *nux vomica*, the *Rhus Toxicodendron*, &c., were recovered by the administration of the seeds of this plant. He recommends to bruise the seeds in a little water; and asserts that it is equally efficacious as an antidote, whether taken internally, or externally applied to an envenomed wound.

The fruit of the *Feuillea* is as large as an apple, and from a fancied resemblance it is called 'the shaving-box.' The seeds contain a fixed oil, which is fit for burning, but it is too bitter to be employed as food. The bitterness of the seeds has caused them to be employed as anthelmintics and cathartics. *F. Javanilla* likewise enjoys in New Grenada a reputation for similar medicinal powers.

(3327.) *Cucumidæ.* Many plants, very useful both as affording food and physic, as well as various domestic utensils, are included in this subtype; such as the eatable gourds, melons, and cucumbers; and the medicinal Elaterium and Colocynth. A bitter purgative principle appears to be common to the whole; and according to its concentration, and the proportion in which it is combined with mild farinaceous matters, either in particular species or even in particular parts of the fruit, it renders them sometimes agreeable food, at others uneatable;

and again, very active medicines, which are occasionally so energetic as to be considered poisonous.

(3328.) *Jollifia* is a genus which appears to be transitional from the preceding subtype to the present. By Hooker it is associated with the *Feuillidæ*, but by De Candolle with the *Cucumidæ*, and it is indeed very nearly related to the *Trichosanthi* of the latter group. *J. Africana* is the *Couémé sonali* of Madagascar. Its fruit is as large as our larger gourds, and each contains from 2 to 300 seeds, as big as ordinary chesnuts. The flesh of the fruit is bitter and not eatable, but the seeds are excellent as food, their flavour being very agreeable, and they are said to be at least as good and nourishing as almonds. They abound in oil, which is easily procured by expression, 50 lbs. of seeds yielding 8 lbs. of bland oil. This plant affords a good illustration of the generalization made by De Candolle, that the seeds of the Cucurbitaceous plants are mild and wholesome, and do not participate in the energetic properties of the rind of the fruit; and it will be found that they are sweet and innocuous even in the poisonous species.

(3329.) The *Cucurbitæ*, or gourds, have received their generic name from the resemblance which the fruits of many species bear to different vessels; and in various parts of the Old and New Worlds, as in Egypt, Arabia, and the West Indies, they are converted into bowls, basons, and other domestic utensils. The *bottle-gourds*, now forming the genus *Lagenaria*, have long necks and capacious bulbs, like flaggons. There are several varieties of *L. vulgaris*, which afford bottles of various shapes, some having single and some double bulbs. When fully grown they form very large flasks, six feet long by a foot and a half in circumference; and when quite young, they are made into spoons. The Arabians call the plant *Charrah*, and the poorer people often eat the fruit boiled with vinegar, or fill the shell with rice and meal, and thus make it into a kind of pudding. Some of the bottle-gourds have a bitter cathartic pulp, which may be used instead of colocynth; but others, especially the cultivated varieties, have a sweet and esculent flesh. These latter are sometimes called *sweet calabashes;* but they must not be confounded with the true Calabashes, which are species of *Crescentia.*

(3330.) *Cucurbita Pepo,* the common pumpkin, is a plant remarkable for its rapid growth; in good soil, and well supplied with water, it will form shoots 40 or 50 feet long, and cover an eighth part of an acre in a season. The fruit of the *Pompion,* corrupted into *Pumpkin,* is eatable, though not in general much esteemed; it wants flavour, but is often made into puddings and pies, with apples and other fruit. Sometimes it is sliced, and at others a hole scooped in it and the hollow filled with apples, spice, and sugar, and then baked entire. On the Continent it forms a frequent ingredient in soups, fricassees, and stews; and it is likewise fried in oil or butter. In many of the French provinces, where it is extensively cultivated, cows, hogs, and other cattle, are fed upon it; and from the seeds large quantities of oil are expressed, which is used both for food and burning.

(3331.) The Vegetable Marrow, which within a few years has become a common and popular vegetable, is a variety of *C. ovifera,* called the *Succade gourd.* When quite young it is very good fried in butter, when half-grown it is excellent, either plain, boiled, and eaten with butter, or stewed in slices with rich sauce; when full grown it is made into pies. The tender tops of this gourd, as well as of *C. verrucosa* and *Aurantia,* and indeed all the species of

Cucucurbita and *Cucumis*, may be used as substitutes for greens, and are very palatable.

(3332.) The fruit of the squash gourd, *Cucurbita Melopepo*, is also esculent; it has the flavour of an artichoke when cooked, and from its form is called in Germany the "Elector's hat."

(3333.) The Water-melon, Cucurbita Citrullus, is referred by De Candolle to the genus Cucumis. The fruit of this species is so very succulent that it melts in the mouth; and is in warm countries, or in hot seasons, a most refreshing article of diet. To the Egyptians it is both food and physic: they eat it in such abundance that it would seem to be almost their only meat and drink; and it is their most common medicine in cases of ardent fever. The fruit grows often to a very large size even in this country; but in Senegal, one has been known to weigh 60 lbs. There are two principal varieties of the Citrullus. In one the flesh is firm, while in the other it is very succulent and juicy; the former is called *Pasteca*, and the latter *Jacé*.

(3334.) *C. Melo* is the well known and much prized melon, the fruit of which when in perfection is scarcely surpassed by any brought to table; and when otherwise, good for nothing. The *Cantaloup* is one of the best varieties; but even this is so uncertain in its flavour, that in France, where it is much cultivated, "to be as deceitful as a melon" has become a proverb. Although this variety has received its name from Cantalou, in Italy, it is said to be there unknown. The melon is a cooling and very refreshing fruit; it is however considered difficult of digestion, and likely to induce colicky complaints: its flavour is heightened by the addition of sugar, and persons who fear its dyspeptic qualities should eat it seasoned with pepper or other spice. There are several sorts of *Cantaloups*, such as the rock, the orange, the Prescot, &c., but the former is the most esteemed. And a few of each of the other varieties, *Reticulatus* and *Maltensis*, are worth cultivation, although inferior to the *Cantaloups*.

(3335.) *Cucumis Dudaim* is the Chemmam of the Arabs, and from the similarity of the name it has been supposed by some to be the *Dudaim* of Scripture; but as the word in one place signifies an eatable root, and in another a fragrant flower, it was not improbably a common name of pleasant or sweet-smelling food. The fruit of this species is eatable, and it is also on account of its fragrance used as a perfume.

C. Chati is the *Abdellavi* of the Egyptians, who not only eat the fruit, but by piercing it when nearly ripe, and breaking down the pulp without removing it from the vine, convert the succulent flesh into a very agreeable and refreshing drink. They stop up the hole after the operation, and let the melon remain uncut for several days.

C. Conomon bears likewise an esculent fruit, from which a sort of beer is made by the natives in Japan.

(3336.) *C. sativus* is the common cucumber, the flavour and properties of which are so well known, that little more requires to be said than that it is a very pleasant and refreshing vegetable when eaten fresh, and forms a palatable ingredient in soups, fricassees, and other dishes, as well as when pickled or preserved in sugar. There are several varieties, of which the green, the yellow, the white, and the variegated, are the chief.

The Cucumber has been employed medicinally, not only as a febrifuge, but also

as a remedy in pectoral complaints; and Hartmann records the cure of a case of consumption (?) which he attributes to the taking a pint of its juice daily. The expressed juice of the cucumber is, however, chiefly used as a cosmetic: it is said to give a very pleasant suppleness to the skin, and it enters into the composition of several of the French pomades.

(3337.) *C. Colocynthis* is the bitter cucumber or Coloquintida of medicine. The bitter purgative principle present in other species, and which is occasionally so much developed as to render the common melons and cucumbers uneatable, is here always produced in such quantities as to form an active drug: indeed, one so energetic that it may be considered a poison. Orfila mentions a case in which most serious symptoms followed an overdose of colocynth; and Dr. Fordyce records another, in which a woman became subject to colic, which lasted for thirty years, by drinking a strong infusion in beer; but, notwithstanding this, Thunberg tells us, that at the Cape of Good Hope the gourd is eaten, being rendered innocuous when properly pickled. The activity of this drug depends upon a bitter principle called *Colocynthine*, which abounds in the rind and pulp. The seeds are free from it, or only rendered slightly bitter on their outsides by contact, and when washed they are mild and tasteless. This cucumber, which is common in the Levant, is supposed by many persons to be the one mentioned in the 2d Book of Kings, where the sacred historian says, that during a time of dearth in Gilgal, "one went out into the field to gather herbs, and found a wild vine, and gathered thereof wild gourds, his lap full, and came and stirred them into the pot of pottage: for they knew them not. So they poured out for the men to eat. And it came to pass, as they were eating pottage, that they cried out, and said (to Elisha), Oh thou man of God, there is death in the pot. And they could not eat thereof," until the prophet had miraculously rendered the pottage wholesome. (c. iv. 5—9.)

(3338.) The *Luffæ* are now generically distinguished from the Cucucurbitæ, amongst which they were once included, on account of the petals being free and deciduous. *L. fœtida*, the *Louff* of the Arabs, is a curious gourd, that twines round palms, and richly ornaments their noble trunks. Its offensive odour, alluded to in its specific name, prevents it being often cultivated here; it is, however, grown in Arabia and China, where the young fruit is pickled like the mango, and eaten by the natives; but by Europeans it is considered neither pleasant nor wholesome.

(3339.) *L. acutangula* is cultivated in the Isles of France and Bourbon for the sake of its fruit, the fleshy part of which is eatable. The rind is woody, and the seeds are said to be possessed of emetic properties; but this is doubtful, as even in the most bitter and active species, such as the colocynth, the seeds are mild and wholesome.

(3340.) *Benicasa cerifera* is the tallow gourd of China. Its fruit is scarcely esculent, but it is remarkable for having its surface, when mature, covered with an exudation resembling wax, and which has something the smell of common rosin.

(3341.) *Momordica Elaterium* is the squirting cucumber, remarkable not only for the sudden separation of the fruit from the stalk when ripe, and the violent ejection of the contents of the gourd, but also for the virulence of its action on the animal economy. *Elaterium* is a term applied by Hippocrates to various drastic purgatives and applications of a detergent nature; it has however been

long especially confined in medicine to the plant in question, which affords one of the most energetic and violent cathartics known. The ancients thought that every part of the plant was active; but Dr. Clutterbuck has shewn that the powerful principle called Elatine is chiefly, if not altogether, confined to the juice which surrounds the seeds, and which, when forcibly ejected on the hands or into the eyes, occasionally produces painful inflammation. To this circumstance may be attributed the very variable strength of the drug as ordinarily prepared, for if much care be not taken the greater part of the potent fluid will be lost by the elastic rupture of the fruit, and its ejection, either while being gathered, or when packed for carriage. For its mode of preparation, see *Med. Bot.* xxxiv.

The root of *Elaterium* is bitter, like that of Bryony, and may be used as a purgative.

(3342.) *M. operculata* bears an eatable fruit, which is remarkable for dehiscing by an operculum at the contrary extremity to that at which the *M. Elaterium* bursts. *M. pedata* and *M. Luffa* have also both of them eatable fruits, while those of *M. Charantia, cylindrica, dioica,* and *purgans,* are irritating cathartics, esteemed as powerful aperients, and often employed as vermifuges. Their differences seem to warrant the separation of the species, which has been proposed by Richard, into two genera or subgeneric groups, the active ones being called by him *Ecbalia.*

(3343.) *Neurosperma cuspidata,* called *Pomme de Merveille* by the French colonists in the Antilles, on account of the brilliancy and beautiful colours of its fruit, is said by M. Descourtilz to be a very poisonous vegetable. He states that about three drachms killed a dog in sixteen hours, and that its extract in moderate doses is a powerful hydragogue. In the Philippines it is used in decoction as an emetic; and the leaves, from their acridity, are applied as counter-irritants to relieve head-ach. This plant is in general thought to be one and the same with the *Momordica Balsamina* of systematic botanists.

(3344.) The fruit of *Tricosanthes palmata* is valued in India as a detergent, and when powdered and mixed with cocoa-nut oil it forms a favorite digestive liniment frequently used to cleanse and heal foul ulcers; the oil is sometimes poured into the ear to cure offensive discharges, and is also introduced into the nostrils as an effectual remedy in cases of ozœna.

(3345.) The Bryony (*Bryonia dioica*), is our only British representative of this type. Its name is a derivative of Βρυω, and alludes to its rapidity of growth: not that it, however, exceeds others of its allies; and that this is a natural phenomenon which early excited attention may be gathered from the history of Jonah's gourd. The *Bryonies* are powerful and irritating cathartics, and in over-doses become acrid poisons. *B. alba* and *dioica* are the species indigenous to Europe, and the effects of which are hence most familiar to us. The roots of these plants are very large and succulent, and to this vast accumulation of nutriment Linneus ascribes the rapidity of their growth. As an example of the magnitude of these roots, the following quotation may be made from Gerarde, who says "the Queene's chiefe chirurgeon, Master William Goodorous, shewed me a roote hereof that waied halfe an hundred waighte, and the bignesse of a childe a yeere old." These roots used to be often grown in moulds, and thus being made to simulate the human form, were sold by impostors as mandrakes to credulous old wives, in former times. The bryony root was formerly esteemed as a powerful diuretic, and considered useful in dropsy; it is now, however, seldom administered internally, but,

as well as that of the *Tamus communis*, is still sold in Covent Garden market, and used by the pugnacious to remove the ecchymoses which follow blows too vigorously applied to the neighbourhood of the eyes. Its acridity renders it a good discutient, but if applied too fresh or kept on too long, it will raise blisters. Bryony root has also been often used when cut in slices to mix with Colomba root, a most vile adulteration, as the properties of the drugs are so dissimilar, and most serious consequences might ensue from the substitution of a drastic purgative for a grateful tonic. This fraud probably originated in a belief which once prevailed, that Colomba was the root of *B. epigæa*, which is said to resemble it in properties, and to be used in India as a remedy in cases of dysentery.

(3346.) *B. Africana* is employed at the Cape of Good Hope as a purgative and emetic, and *B. grandis* and *callosa* are valued in India in veterinary practice; the seeds of the latter also afford by expression a good oil, which is valued for burning. *B. scabra* is slightly aperient, and *B. cordifolia* and *rostrata* are considered in India as useful expectorants; and the latter is also employed as an astringent and emollient poultice for the relief of hæmorrhoids.

(3347.) Goats are the only animals that feed voluntarily on the leaves of our European bryonies. Withering, however, says that a decoction of the fresh root is one of the best cathartic medicines for horned cattle; and that it is a common practice in Norfolk to give small quantities to horses mixed with their corn, to render their coats glossy and fine. Dr. R. Pearson also gives it as his opinion, that, under many circumstances, "it would very well supply the place of jalap."

(3348.) Papayaceæ. The *Papaw*, like the fig-marygolds, the Indian figs, and the grossulariæ, have been called *Caricæ*, from their resemblance to the fig. But as the Papaws have no immediate connexion with the figs, and are not natives of Caria, but of India, the Caraccas, and Guiana, it would be well to adopt, with Jussieu, the Latinized *Papaya* as the common generic name.

(3349.) The *Papayaceæ* are branchless trees, with alternate lobed leaves, on long slender petioles, and abounding in acrid milky juices. The inflorescence is axillary and racemose, and the flowers regular and diœcious. The calyx is inferior and free, the sepals 5, small, and united, having a 5-toothed limb. The corolla is pentasynpetalous. In the stamineous flowers the union of the petals is complete, and the limb of the corolla only lobed. The stamens are 10 in number; those which are opposite the lobes have sessile anthers, those which are alternate with them are supported on short filaments. The anthers are adnate, 2-celled, and dehisce lengthwise. In the pistilline flowers the petals are much less united, and the limb of the corolla is separated into 5 deep segments, the clefts reaching almost to the base. The germen is superior and 1-celled, with 5 parietal trophosperms, and many ovules, style none, and the stigma 5-lobed and lacerated.

The fruit is a succulent indehiscent gourd, 1-celled, with 5 parietal placentæ, and many seeds. The seeds are invested with a loose mucous tunic (arillus ?), and have a brittle pitted testa. The albumen is fleshy, the embryo axile, the radicle taper and turned towards the hilum, and the cotyledons flat.

(3350.) Hence, differentially considered, the *Papayaceæ* are synpetalous unbranched arboreous *Rosares*, with a superior 1-celled fruit, and polyspermous parietal placentæ; or lactescent *Cucurbitinæ* with albuminous seeds.

(3351.) The foliage of the Papaws and their milky juices have suggested a connexion between them and the *Urticinæ*, especially with the figs; but their fruit and flowers both remove them from the Querneal sections, and bring them to

the confines of the Rosales and Syringales; their fruit associating them with the Cucurbitaceæ and Passifloraceæ of the former, and their flowers with the latter order: their habit is, however, peculiar.

(3352.) The fruit of the common Papaw is about the size of an ordinary melon; it is esculent and wholesome, but not very palatable. It is cultivated in many of our Indian possessions, and eaten both raw and cooked. It is usually gathered when about half-grown, and soaked in water to withdraw the acrid milk, like mangoes, for which it is considered a good substitute. The juice of the unripe fruit is said to be an efficient vermifuge, and even the seeds are reported to possess anthelmintic powers. The milky sap, on account of its acridity, is sometimes employed as a remedy for ring-worms. M.M. Vauquelin and Cadel have discovered that the milk of the papaw, besides oil, contains a large proportion of fibrin, a substance very rare in vegetables, and almost peculiar to animals and fungi.

(3353.) The exhalations from the papaw are affirmed to have the very singular property of intenerating the toughest animal matters; and hence it becomes economically important, for newly killed meat suspended among the leaves soon becomes tender; and even old hogs and patriarchal cocks and hens, if fed upon the leaves and fruit, are made in a few hours as tender as young pigs and pullets.

(3354.) *Flörkea*, a genus which has been referred to many different natural orders, such as on the one hand to *Juncaceæ* and *Hydrocharideæ*, and on the other to the neighbourhood of Portulaceæ and Cruciferæ, having been, as Lindley says, a kind of botanical puzzle, seems, from some late examinations of its structure before but imperfectly understood, to belong, without doubt, to the present sub-order, for it is proved to be a polypetalous dicotyledon with perigynous stamens, but to which type it should be referred is not so certain; for, although it agrees in several particulars with *Sanguisorbaceæ* more than with any other group, still it differs in so many points, that it appears most safe to leave it unattached until its affinities shall have been more satisfactorily made out.

ANGELICOSÆ.

(3355.) The *Angelica, Hemlock,* and their numerous allies, such as the Carrot, Parsnip, Coriander, Celery, Anise, Dill, and Fennel, familiarly known as umbelliferous plants, are associated with the *Aralia, Ginseng, Ivy, Cornel,* and a few other genera, such as the *Aucuba, Mistletoe,* and *Loranthus,* which deviate more or less from the usual normal umbelliform mode of inflorescence, to constitute the suborder *Angelicosæ*. This suborder includes six types, which are distributable into three sections; and these, from *Loranthus, Angelica,* and *Aralia,* the respective normal genera of each, may be called the *Loranthinæ, Angelicinæ,* and *Aralinæ.*

(3356.) The *Angelicosæ,* which combine the *Umbellatæ* with the *Hederaceæ* and part of the *Loranthine Aggregatæ* of Linneus, are nearly equivalent to the epigynous polypetalous dicotyledons of Jussieu, and the epipetalæ of Richard. These, as already observed, are blended with the *Calyciflora* by De Candolle: but, although their affinity is great, it is not greater than that of many of the calyciflorous groups (*Myrtosæ*), with the thalamiflorous ones (*Rhœadosæ*), such as the *Terebinthinæ* with the *Rutinæ*, the hypogynous *Leguminosæ* with the *Cruciferæ*, &c. and one of the nearest connexions of the ivies of the *Aralinæ* is thought by many to be with the vines of the *Rhœadosæ*. It seems therefore, as formerly contended, most advisable to segregate the epipetalous or epigynous Rosales after the manner of Richard and Jussieu, if the hypogynous and perigynous ones

are to be distinguished from each other. For it is at once acknowledged that such a separation is only admitted conventionally and for the sake of convenience, and the reciprocal and varied affinities of the segregated groups are to be as scrupulously regarded as ever.

(3357.) Selecting the most general characters as the differential signs, the *Angelicosæ* are epipetalous or epigynous *Rosales, i. e.* dichlamydeous dicotyledons with inferior ovaries, epigynous disks, albuminous seeds, and the flowers almost invariably disposed in umbels.

LORANTHINÆ.

(3358.) *Loranthus* and *Viscum*, both of which prefer a claim to be considered the sacred mistletoe of the Druids, are the two principal genera included in this section, and they are associated to form a single type, the *Loranthaceæ*. To these *Aucuba* is added by Richard and Bartling; but, although the situation of this genus cannot be absolutely determined until the structure of its fruit is better known, its habit and mode of inflorescence would seem, as De Candolle observes, to connect it rather with the *Corneaceæ* than the *Loranthinæ*. It is not improbable, however, that it may be hereafter shewn to be the type of a transitional group intermediate between this section and the *Aralinæ*.

Loranthus parviflorus.

c. Entire plant, to shew its parasitic habit.

(*a*) A flower isolated, to shew its calyculate calyx and valvate corolla.

(*b*) Corolla opened, to shew the adhesion of the petals, and the stamens opposite and adnate to the lobes.

(*c*) Calyx and pistil, to shew the inferior germen and entire limb.

(*d*) The fruit.

(*e*) Section of the same, to shew the inverted seed with its embryo and albumen.

(*f*) The seed detached.

(*g*) The embryo with its thickened radicle.

(*h*) The embryo with the cotyledons apart, shewing the naked piercing radicle.

(*i*) The seed while germinating.

(3359.) The *Loranthinæ*, differentially considered, are epigynous *Rosales* or *Angelicosæ*, with the petals usually discrete, (occasionally connate,) and the stamens opposite, and equal to them in

number. They are also for the most part parasites, with shrubby or suffruticose stems.

(3360.) LORANTHACEÆ. The mistletoe and its allies are shrubby plants, in general true parasites, and very rarely growing in the ground. Their leaves are opposite, entire, fleshy, and ribless, seldom alternate or absent, and exstipulate. Their habit is variable.

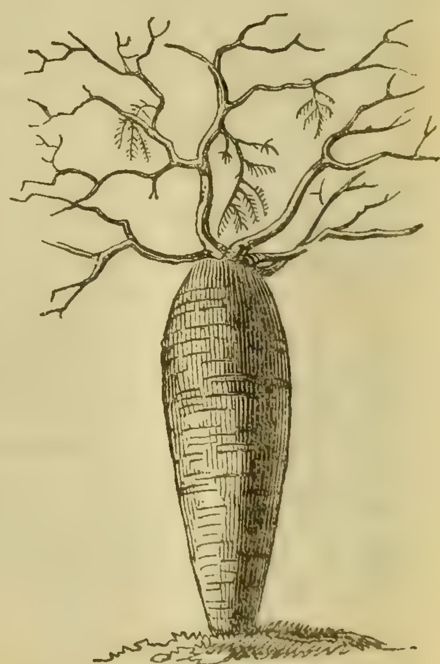
The inflorescence is terminal or axillary, and the flowers, often monœcious, are either solitary corymbose or spicate.

The calyx is superior, and calyculate with two bracteæ. The tube adnate to the germen, and the limb either toothed, or short and entire. The disk is epigynous, and sometimes annular. The petals are 4-8, either free or more or less united by their ungues, which are broad, and valvate in æstivation, sometimes, but rarely, abortive. The stamens are equal in number to the petals and opposite to them. The filaments when present, or when absent the anthers, are connected to the petals: the anthers are 2-celled, and dehisce lengthwise by clefts. The germen is inferior, ovate, or turbinate, unilocular and uniovulate, and the ovule pendulous, style 1 or nearly absent, and stigma simple.

The fruit is a 1-celled 1-seeded berry, with the glutinous flesh adherent to the pendulous seed. The testa is membranaceous, and the embryo cylindrical, longer than the fleshy albumen. The radicle is thickest or truncate at its extremity and superior, and the cotyledons for the most part oblong and entire.

(3361.) Being the only type included in the section, one differential character will suffice both for the *Loranthaceæ* and *Loranthinæ*, [§ 3349.] Their fleshy ribless leaves and carneous albumen may however be added, as further distinctive signs.

(3362.) The germination of these parasites, and the insertion of their roots within the substance of other living vegetables, are subjects replete with physiological interest. From an elaborate series of experiments made by Dutrochet, it appears that the radicle of the germinating mistletoe seed does not, like other radicles, tend towards the centre of the earth during its development, but towards the centre of the mass of matter, *i. e.* the arm or trunk of the tree to which it is attached, so that, if placed on one side, it grows horizontally or rather laterally, and if below, it shoots directly upwards. The roots of the Loranthaceæ are always simple; and so greedily do they suck up the vital juices of the plants on which they live, that even fluids coloured by art may be detected in their transit. They will grow on almost all exogenous trees, the lactescent ones only excepted, and in tropical America and Asia, where the



Chorisia insignis ventricosa.

more shewy Loranthi are common, they often, with their pendent clusters of rich scarlet blossoms, outvie in splendour and almost supersede the flowers and foliage of their nursing stocks. Spix and Martius give a figure of the extraordinary *Chorisia insignis* ventricosa infested with Loranthi.

(3363.) *L. Europæus* is in the southern parts of Europe a very frequent parasite on the oak, and indeed inhabits no other tree, while the viscum is very seldom found thereon, being chiefly confined to the hawthorn and the apple. This circumstance has led some naturalists to suppose the *Loranthus* to have been the mistletoe of the Druids, and to believe, as it is not now indigenous to Britain, that when Druidism was suppressed every vestige of that stupendous superstition was so completely swept away, that even the sacred plant was extirpated here. Such a speculation, however, seems so wild, that the following is offered in its stead.

The mistletoe, although seldom found on the oak, is not exclusively a parasite of other trees, and its rarity on the former not improbably led to the preference which the old botanists, as well as the Druids, gave to the *Viscus quercûs* over the *Viscus oxyacanthi*, when these vegetables were held in much repute in medicine. Hence the very circumstance of a *search* being made for quercine mistletoe, in an age when these islands were covered with forests of oak, is opposed to the idea of the *Loranthus* being the plant in question: had it then been indigenous here the oak would have been its common, if not exclusive habitat, and this confirms the belief that the *Viscum* was the branch which the Druids went with such solemnity to cull.

(3364.) The common mistletoe is slightly astringent, and is occasionally resorted to in our provinces as a cure for epilepsy or the falling sickness; but trust in its sanative powers is at as low an ebb as credence in its moral efficacy. The all-health and the yule-log of the Druids are now only regarded as means of Christmas comfort for the old and pastime for the young.

The berries of these plants abound in a viscid matter, from which bird-lime is often made. Thrushes and other small birds feed upon them; and, as the seeds pass through their intestines uninjured, they are lodged, after having been stimulated to germination by animal heat, in the situations most fitted for their growth: and hence, as the old doggrel rhyme affirms,

> "The thrush when he pollutes the bough,
> Sows for himself the seeds of woe."

(3365.) The Loranthi are said to be, like the mistletoe, slightly astringent; and one species, *L. corymbosus*, is used as a dye in Chili, where it is called *Ytin*.

ARALINÆ.

(3366.) Certain plants, such as the Cornel, Ivy, Ginseng, and their allies, in which the umbellate inflorescence, and several other peculiarities of the Angelicinæ, although anticipated, are not fully confirmed, are associated to form this section, which may hence be considered transitional from the preceding to the next. The *Araliaceæ* are certainly the nearest allies of the true *umbellatæ*: and the *Corneaceæ*, which are scarcely separable from the former, are likewise so intimately connected with the *Loranthinæ*, that, as already noticed, *Aucuba* is sometimes referred to the one group, and sometimes to the other, just as *Hedera* is associated with *Cornus*, by Jussieu and Bartling, and with *Aralia*, by De Candolle: a

further relationship is also traceable from these plants to the *Caprifoliaceæ* of the *Syringales.*

(3367.) Differentially considered, the *Aralinæ* are epigynous *Rosales* or *Angelicosæ,* with valvate petals, broad at the base, and the carpels not separable in the mature fruit.

(3368.) Corneaceæ. The *Cornels* and their allies are trees or shrubs, rarely herbs, with simple opposite* leaves, destitute of stipules. The inflorescence is capitate or umbelliform, and often involucrate. The flowers are regular and united, rarely by abortion diclinious.

A

Cornus mascula.

A. Branch to show the opposite leaves and fruit.

(*a*) Inflorescence.

(*b*) A flower isolated.

(*c*) Vertical section of the pistil, to shew the 2-ovuled ovary, inferior germen, and epigynous disk.

(*e*) Drupaceous fruit.

(*d*) Stone of the drupaceous fruit.

(*f*) Section of ditto, to show its 2 cells.

(*g*) Stone in which the abortive cell has disappeared.

(*h*) Transverse section, before the abortive cell has been obliterated.

(*i*) The embryo.

The calyx is 4-sepaled, the ungues concrete and adnate to the germen, the limb superior and 4-lobed. The petals four, oblong and broad at their bases, regular, exserted from the disk or summit of the tube of the calyx, alternate with the sepals, deciduous, and valvate in æstivation. The stamina are definite, equal to the petals in number, and alternate with them, being exserted from the disk opposite the sepals. The filaments are free, and the anthers ovato-oblong, 2-celled, and dehisce lengthwise. The germen is inferior, formed of 2, seldom 3 carpels, the style is filiform, and the stigma simple.

The fruit is drupaceous or baccate, crowned with the vestiges of the calyx, when young 2- (or rarely 3-) celled, and the seeds pendulous and solitary. The albumen is fleshy. The embryo axile and straight, and the radicle superior and shorter than the 2 oblong cotyledons.

(3369.) Hence, differentially considered, the *Corneaceæ* are tetrandrous *Aralinæ,* with 4-petals, broad at the base, and a 4-2 or rarely 3-celled baccate fruit, the

* In *Mastixia pentandra* alone are the leaves alternate.

carpels inseparable, the seeds solitary and pendulous, and the radicle shorter than the cotyledons. The leaves are opposite.

(3370.) Not any of the *Corneaceæ* are hurtful plants. They are generally bitter and astringent, and the bark and leaves have been used as styptics and febrifuges.

C. circinnata, mas, alba, sericea, and *florida,* are the species that have been most recommended; the former in cases of diarrhœa, the others in ague. From the latter a peculiar principle called *cornine* has been procured, of similar and equal powers to quinine; and Barton says that this plant is the best substitute known for Peruvian bark.

(3371.) The fruit of the cornels is eatable, and used to be made into tarts, but it is too astringent to be pleasant. The berries of *C. Suecica* are said to be tonic, and to increase the appetite, whence its Highland name *Lus-a-chrasis,* or *plant of gluttony.* The fleshy part of the fruit of *C. sanguinea* abounds in oil, which in many parts of the continent is extracted by boiling and pressure, both for burning and for table use. The berries yield about a third of their weight of oil, and M. Granier, in a memoir addressed to the Institute of France, says the cost of its extraction would not exceed 4 sous per lb. The wood of the cornels is hard, and the large trunks are valued for millwork, while the smaller branches and twigs are made into lace-bobbins, butchers' skewers, and toothpicks. It also affords one of the best charcoals for the manufacture of gunpowder. *C. sanguinea* is a valuable shrub in close plantations, as it will grow under the drip of other trees. The young twigs of *C. Florida,* stripped of the bark and rubbed endwise against the teeth, are said to render them extremely white. The berries of *C. Chilensis* are eaten in Chili, and the natives make a sort of drink with them, which they call *Theca.*

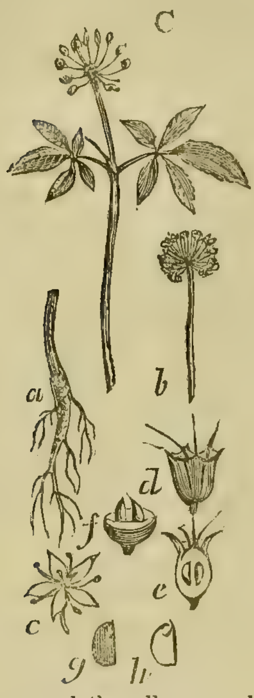
(3372.) *Aucuba Japonica* is a well known ornamental evergreen. Loudon says that the stamineous flowers alone were for many years observed to be developed in our gardens, but I have frequently found the pistilline ones. They are green without, and of a purplish red within, but on the whole insignificant, the leaves being the chief beauty of the plant. The fruit is said to be a red oblong drupe, with a sweetish eatable pulp, and a bitter kernel.

(3373.) *Polyosma,* referred to this type by De Candolle, is an aberrant genus, as its fruit is incompletely 2-celled and many-seeded.

(3374.) Araliaceæ. *Aralia, Panax,* and their questionable allies, *Adoxa* and *Hedera,* are trees or shrubs, rarely herbs, with sometimes scandent stems, and occasionally furnished with root-like holdfasts. The leaves are alternate, exstipulate, petiolate, and either simple or variously compound. The petioles are long, and always dilated and thickened at the base. The inflorescence is axillary or terminal, umbellate or capitate, the umbels occasionally becoming racemes or panicles, and often involucrate. The flowers are regular; either united or separate.

The tube of the calyx is adnate to the germen, the limb entire or toothed. The petals are definite, 5-10, alternate with the lobes of the calyx, and exserted from the epigynous disk, broad at their bases, entire, and valvate in æstivation; rarely, as in *Adoxa,* absent, when they are probably converted into stamens. The stamina are free, definite, equal to, or rarely double the petals in number, and exserted from the epigynous disk below its margin. The anthers are 2-celled and peltate (Don), and burst lengthwise. The germen is adnate to the calyx, formed of

2 or more concrete carpels, with solitary pendent ovules. The styles are simple, distinct, or connate, rarely abortive, and the stigmata are simple. The fruit is dry or baccate, 2-15 celled, crowned with the entire or toothed limb of the calyx, the cells 1-seeded, and the carpels not separating when mature. The seeds are angular, erect, according to Don; pendulous, according to Bartling, and other authors; the testa crustaceous and adherent to the pericarp: the tegmen membra-



Panax quinquefolium.

c. Cutting, to shew the plant with the sheathing petioles of the leaves, and umbellate inflorescence.

(*a*) The root.

(*b*) The umbel of flowers.

(*c*) A flower separated.

(*d*) The fruit.

(*e*) A longitudinal section to shew the concrete and inseparable carpels.

(*f*) Transverse section.

(*g*) A seed.

(*h*) Section of ditto, to show the copious albumen, inverted seed, and superior radicle.

naceous, and the albumen abundant and fleshy. The embryo is small, straight, and axile, the radicle superior, and longer than the foliaceous cotyledons.

(3375.) Hence, differentially considered the *Araliaceæ* are a- or poly-petalous *Aralinæ*, with 5 or more stamens, peltate anthers; 2-15 celled undividing fruit, superior radicle, twice as long as the cotyledons, and alternate exstipulate leaves, with sheathing, thickened petioles.

(3376.) It is not improbable that *Adoxa* and *Hedera* may be hereafter admitted as the normal genera of two subtypes, which might be called *Adoxidæ* and *Hederidæ;* the former connecting the true *Araliaceæ* or *Aralidæ* with the Saxifrages, and the latter with the cornels and the vines: but for the present it appears advisable to follow the example of De Candolle, and leave them associated without any subtypical segregation.

(3377.) *Hedera Helix*, the common Ivy, is said to have been so named from its spiral scandent stems, adhering firmly to the trees and walls over which it spreads. Of this species there are several varieties, some of them depending simply on the age of the plant, and others upon soil or climate. Thus the *Hedera humilis humi repens*, *H. major sterilis*, *H. poetica fertilis*, and the *H. arborea*, once considered specifically distinct, are but examples of infancy, youth, maturity, and old age, in one and the same plant,—only well-marked illustrations of the successive epochs of vegetable life.

(3378.) The Ivy was held in much esteem by the ancients; it formed both the Bacchanalian fillet and the poet's crown. It was once supposed to prevent drunkenness and to dissipate the effects of wine, but it does not seem to possess any peculiar powers; the leaves have an austere and bitter taste, and the berries are bitter, aperient, and emetic. Boyle commends it as a sudorific, and an infusion of the fruit in vinegar was thought to be serviceable in those plagues with which London was once afflicted. Sheep will eat the leaves of ivy, and many birds feed upon the berries; still they are unfit for human food, and the ivy is now chiefly valued as an ornamental evergreen, well fitted to cover walls and unsightly buildings.

(3379.) *H. vegeta*, by some regarded as a distinct species, and by others as a variety of *H. Helix*, is a native of Madeira, although it is commonly known here under the name of *Irish* or *Giant Ivy*.

(3380.) In the south of Europe and Northern parts of Africa an exudation is found on the old trunks of the ivy, which is called ivy-gum. It however contains much more resin and lignin than gum. It has an agreeable odour when burned, and is sometimes substituted for gum-Bassorah. It is reputed to be a stimulant and emmenagogue, and has been employed to allay the pain of carious teeth.

(3381.) The true *Araliaceæ* or *Aralidæ* are all innocuous plants, and several are more or less esteemed as tonics. The *Ginseng, Panax quinquefolium*, has from immemorial ages, been extolled in China as a universal medicine or *panacea*, whence its present generic name, which is a compound of *παν ακος*, and signifies a remedy for all things. But, notwithstanding its foreign fame, it is very little used in Europe; perhaps its high sounding title, having led to undue expectations, may have caused it to fall into unmerited neglect; for it does seem, when fresh, to be an agreeable stimulant and tonic. Père Jartroux says that the most celebrated physicians of China have written volumes on the *Gen-seng*, which they affirm to be able to ward off or to remove fatigue, to invigorate the enfeebled frame, to restore the exhausted animal powers, to make old people young, and, in a word, to render man immortal: (this saving clause being however added,) "if any thing on earth can do so." Hence the name *Gen-seng*, *Jin-chen*, or *Nindsin*, which signifies "wonder of the world," or the "dose for immortality." Osbeck says the Chinese take it every night and morning in their tea or soup, and that he never looked into the apothecaries' shops but they were always selling ginsing. The plant is a native of North America as well as of Chinese Tartary; it grows chiefly in desert places difficult of access, or at least, the venders tell strange tales of dangers encountered by those who collect the root, perhaps with the design of enhancing its value; and it has been known to cost its weight in gold.

P. fruticosum is also used in China and Cochin-China as a febrifuge and astringent tonic.

(3382.) Several species of *Aralia*, such as *A. hispida, spinosa*, and *nudicaulis*, are said to be alterative and tonic. The first is likewise famed as a sudorific, and the last is affirmed to be as valuable a medicine as sarsaparilla. *A. octophylla* is reputed to possess diuretic and diaphoretic powers; and a tincture of the wood of *A. spinosa* is a favorite remedy in Virginia to allay the spasms in colic. *Hedera umbellifera* of De Candolle, the *A. umbellifera* of Lamarck, yields an aromatic

gum resin, which, from its odor when burned, seems to contain benzoic acid. In Amboyna it is called *Saruru*.

(3383.) Several species of *Aralia*, such as *A. humile, palmatum, scandens*, and others, are remarkable for the cohesion of the petals by their apices, so as to form a calyptra; and hence they have been generically distinguished from the *non-calyptrate araliæ*, and called *Sciodaphylla*. One species, *Sciodaphyllum*, is parasitic; and hence, with the subparasitic *Hedera* or *Aralia parasitica*, and the pseudo-parasitic ivies, another connexion is established with the *Loranthinæ* by similarity of habit.

(3384.) *Adoxa*, as its name imports, is a plant of little beauty. Its inglorious aspect appears to arise from the conversion of its petals into stamens rather than from their absolute suppression. That such an account of its apetalous flowers is physiologically correct seems to be proved by the position of the supernumerary stamens, which alternate with the sepals in the place of the petals, while the intermediate ones are opposite the sepals, in their normal situation.

ANGELICINÆ OR UMBELLATÆ.

(3385.) It is curious that the mode of inflorescence, for the most part so inconstant, and which varies so much in different

A. *Conium maculatum*. Cutting to shew the leaves and inflorescence.
(*a*) A flower isolated, to shew its 5 petals and 5 stamens.
(*b*) The fruit, consisting of 2 mericarps with their commissure, ridges, vallecules, and persistent styles with epigynous disk.
(*c*) Transverse section of the fruit, shewing the apposition of the mericarpia, the embryo, and the laterally incurved albumen (characteristic of the Smyrniaceæ or campylospermous Umbelliferæ), the axis, and the commissure.
(*d*) Longitudinal section, shewing the small embryo and superior radicle.
(*e*) The embryo isolated.

B. *Petroselinum sativum*. Cutting to shew the foliage and inflorescence.
(*a*) A flower separated.
(*b*) The fruit, composed of two mericarpia, and surmounted by the epigynous disk and persistent styles.
(*c*) The mericarpia separated, shewing the axis.
(*d*) Section of the albumen, to shew its plane internal surface, characteristic of the orthospermous Umbelliferæ or Angelicaceæ.

species of the same genus, should characterize several of the larger and more natural groups of plants, such as the miscalled

Compositæ, *Amentaceæ*, *Coniferæ*, and *Umbellatæ*; groups which, from their great and notorious similitudes, have universally been recognized as natural associations, and admitted to be such, even by those who doubt or deny the general application of the system of affinities. But as the old *Coniferæ* and *Amentaceæ* did not universally or exclusively flower in aments or bear cones, [§ 1370-1508, *et seq.*] so capitula and umbels do not exclusively belong to the miscalled compound flowers and umbel-bearers; some other plants being as constantly umbelliferous and capitulate. Hence the mode of inflorescence, although one of the most remarkable characteristics, is not an absolute differential sign; indeed, the alliance of the genera here associated is sustained on other more important though less conspicuous points of structure. Therefore, as in the case of the *Compositæ*, (an intolerable term,) it seems advisable to designate this section from some well-known genus, such as *Angelica*, from which, in conformity with the present scheme of nomenclature, it may be called ANGELICINÆ, instead of *Umbelliferæ*; just as the *Coniferæ* are termed PINARES, and the true *Amentaceæ* QUERCINÆ.

(3386.) When the general similitude is remarkable, and the association of a large group easy, from the number and strict accordance of its primary characteristics, its special distribution is rendered in an equal ratio difficult, by its secondary distinctions being necessarily few, often faint, and sometimes artificial. Of this the grasses afford an apposite example, and the *Umbellatæ* and *Compositæ* are in a similar predicament. For although the subordinate groups of the *Angelicinæ*, being founded on important structural peculiarities, are here admitted as types and subtypes, it is a question still undecided whether or not they should be regarded as anything more than merely artificial subdivision, and even the limits of the genera are more than debateable. They seem, however, to be advantageously introduced in a physiological as well as in a systematic point of view; for *Sanicula* and *Hydrocotyle* among the *Angelicaceæ*, like *Adoxa* among the *Araliaceæ*, tend towards the Saxifrages in habit; the *Mulina* are suffruticose, and the *Saniculidæ*, in general, by their sertulate inflorescence and evittate fruit, seem to shew that the umbelliferous character is scarcely established in that subtype.

(3387.) The distribution of this extensive group as adopted from Koch and De Candolle, may perhaps be most conveniently exhibited in a tabular conspectus; and, as the subdivisions are only conventional, and differ but little from each other, the general description will refer to the entire section, and the peculiarities of the types be given merely as differential signs, in order to avoid a useless repetition.

Section.	Types.	Sub-types and districts.
ANGELICINÆ or UMBELLATÆ.	Angelicaceæ or Orthospermæ	*Saniculidæ*
		Hydrocotyleæ
		Mulineæ
		Saniculeæ
		Angelicidæ
		Ammineæ
		Selineæ
		Angeliceæ
		Peucedaneæ
		Tordylineæ
		Daucidæ
		Silerineæ
		Cumineæ
		Thapsieæ
		Daucineæ
	Smyrniaceæ or Campylospermæ	*Caucalidæ*
		Elæoselineæ
		Caucalineæ
		Scandicidæ
		Scandicineæ
		Smyrneæ
	Coriandraceæ or	*Cœlospermæ*.

(3388.) The *Angelicinæ*, collectively considered, are herbs or herbaceous plants, rarely undershrubs, with a variable but often fusiform root, a round or angled knotted stem, either simple or alternately branched, and annual or persistent; the cortical part frequently abounding in aromatic gum-resin; and the pith, sometimes very large (as in Ferula,) with fibres interspersed, resembling the stems of monocotyledons, while at others it is reduced to a thin lamina lining a fistular cavity. The leaves are alternate, rarely, except the seminal ones, opposite; more or less divided, but occasionally simple, and exstipulate, with sheathing petioles called pericladia, which are sometimes inordinately developed, like the phyllodia of the New Holland acaciæ, to the abortion of the leaf-planes, and thus simulating simple leaves.

The inflorescence is umbellate, occasionally in sertula or simple umbels, but most frequently in compound ones, and rarely imperfect by abortion or capitate by the shortening of the rays. The umbels are furnished with whorls of bracteæ, called involucra and involucella, both of which are sometimes present, and at others either or both are absent. The flowers are united, or by abortion separate or sterile; generally white, rarely pink, yellow or buff.

The calyx consists of 5 sepals, the ungues of which are adnate to the inferior germen, and the limb sometimes truncate or obsolete; at others entire or 5-lobed, the lobes being deciduous or persistent; the disk is epigynous, fleshy, and nectariferous; the petals (rarely absent) are definite (5) exserted from the outer edge of the disk, alternate with the sepals, and involute or subimbricate, rarely valvate in æstivation; the ungues are narrow, and the laminæ either entire, emarginate, or inflexed at the point, and the outer ones occasionally the largest and radiant. The stamina are definite (5) exserted with the petals, but alternate to them and opposite the sepals; the filaments are free and replicate in æstivation; the anthers ovate, 2-celled, subdidymous, and dehiscent longitudinally by clefts. The germen is inferior, formed of two adhering carpels, hence 2-celled, or rarely by abortion

1-celled, and the cells 1-ovuled. The styles are two and simple, more or less thickened at the base, erect when young, but subsequently divergent and persistent; one being directed towards the axis, the other towards the circumference of the umbel or umbellule; the stigmata are simple.

The fruit consists of two carpels or mericarpia, with a central filiform double columella, adhering by their faces when young, forming the commissure, but separating at maturity from each other, and from the axis: rarely concrete, or solitary by abortion, and maintaining the same relative position in the umbels as the styles. The fruit being inferior, the carpels are covered externally by the lobes of the calyx, and hence is not simply a diakenium, but consists of two mericarpia. Each mericarpium is traversed by longitudinal ridges, five of which are primary and four secondary; of the ten primary ridges in the two mericarpia which form the fruit, the five that represent the midribs of the sepals, which constitute the calyx, and are produced into the teeth or lobes, of its limb, are called carinal, while the other five, that indicate the union of the sepals and terminate in the sinuses of the calyx, are called sutural. The secondary ridges, which are occasionally absent, are the vestiges of the lateral ribs of the sepals. The channels between the ridges are called vallecules, and in them there are often found bands called vittæ. These vittæ are linear receptacles, containing essential oil, and they are seldom absent. The seed is solitary and pendulous, usually inseparable from the pericarp, rarely loose. The albumen is large, fleshy or subcorneous, more or less convex externally, but internally either flat and smooth, as in the Orthospermous Angelicaceæ, or folded in at its sides, as in the Campylospermous Smyrniaceæ, or rarely incurved from base to apex, as in the Cœlospermous Coriandraceæ. The embryo is small, at the base of the large albumen, the radicle is superior, and the cotyledons oblong, slightly unequal size, and changing into seed-leaves during germination.

(3389.) Hence, differentially considered, the *Angelicinæ* or *Umbellatæ* are epigynous *Rosales* or *Angelicosæ*, with discrete involute or subimbricate petals, narrow at the base, two styles, and two carpels, forming by their separation mericarpia, solitary pendulous ovules, umbellate inflorescence, and exstipulate sheathing leaf-stalks.

(3390.) The several peculiarities of the Angelicinæ render a copious description necessary; but, although that of the section is extensive, the types, as before observed, will merely require a differential character to be given. These types are three in number, and they are distinguished from each other by the form of the albumen.

(3391.) In the ANGELICACEÆ or Orthospermæ, the albumen is flat, or nearly so, on its inner side.

(3392.) In the SMYRNIACEÆ or Campylospermæ, the albumen is curved inwards at its sides, forming a longitudinal furrow.

(3393.) And in the CORIANDRACEÆ or Cœlospermæ, the albumen is curved lenthwise, being involute from base to apex.

(3394.) The subtypes are founded upon the diversities that occur in the form of the umbels, the presence or absence of the vittæ, and the number of the ridges. The districts are subordinately distinguished by the form of the fruit, and the genera frequently by the outline and position of the juga.

(3395.) ANGELICACEÆ, the genera here associated by their flat albumen are

distributable into three subtypes; the *Saniculidæ, Angelicidæ*, and *Daucidæ*, the diagnoses of which are founded upon the diversities that occur in the form of the umbels, the presence or absence of the vittæ, and the number of the ridges. Thus,

(3396.) In the *Saniculidæ* the inflorescence is sertulate, that is, the umbels are simple or imperfect, and the vittæ absent.

(3397.) In the *Angelicidæ*, the umbels are compound or perfect, the vittæ present, and the ridges few, the primary ones only being developed.

(3398.) The *Daucidæ* differ from the Angelicidæ in being multijugate, both the primary and secondary ridges being present.

(3399.) *Saniculidæ.* The genera associated in this subtype are distributable into three smaller groups or districts, called *Hydrocotyleæ, Mulineæ*, and *Saniculeæ.*

(3400.) In the *Hydrocotyleæ* the fruit is laterally compressed, and the mericarps convex or acute posteriorly.

(3401.) In the *Mulineæ* the fruit is contracted at the commissure, and parallelly biscutate, with the mericarps plane posteriorly.

(3402.) In the *Saniculeæ* the fruit is ovato-globose.

(3403.) *Hydrocotyleæ.* Hydrocotyle, the water-cup, is remarkable for its sertula, often few-flowered, being sometimes reduced to a single blossom, so that the inflorescence ceases to be umbellate. *H. vulgaris*, the common water-cup, white-rot, flowkwort, or sheep-killing penny-grass, has received its latter names from an old belief that feeding upon it caused the liver-rot in sheep. This opinion, which is altogether an error, arose from the Fluke or flounder insect (Fasciola hepatica,) being found in marshy grounds where the Hydrocotyle and other similar plants abound; but sheep are well known never to eat this plant. *H. Asiatica* is said to be used in India as a diuretic, and also to be eaten as a culinary vegetable. *H. umbellata*, in small doses, is affirmed by Martius to be serviceable in hypochondriasis. Pison commends its aromatic odour and agreeable taste; but in large doses its fresh juice is said to be emetic.

(3404.) *Mulineæ*, the gum-bearing white rot of Lamarck, is now called *Bolax Glebaria.* It exudes abundantly from its stem a semi-transparent reddish gum, like that of the apricot-tree, and which might be used for similar purposes.

(3405.) *Saniculeæ.* The Sanicle, (Sanicula Europea,) was so called for its once reputed powers of healing. It is a slightly acrid plant, but its curative powers having been shewn to be imaginary it is rejected in modern medicine.

(3406.) The roots of Astrantia major are acrid, and are said by Morison to be purgative also.

(3407.) Several species of Eryngo are possessed of medicinal powers. *Eryngium campestre* is bitter and tonic, and it was once reputed to be aphrodisiac likewise. Its root, as well as that of *E. maritimum*, used to be candied, and formed the 'kissing comfits,' much esteemed in Shakspeare's time, as appears by the mention made of them by Falstaff. Linneus says, that the young tops of these plants are eaten like asparagus in Sweden. And Belon states, in his *Singularités*, that the same custom prevails in Crete. In the United States, the root of *E. aquaticum* are employed as a sudorific; and in Jamaica, that of *E. fœtidum* is esteemed as an emmenagogue and febrifuge.

(3408.) *Angelicidæ.* This subtype is distributed into five districts or subordinate groups, which, from the genera *Ammi, Seseli, Angelica, Peucedanum,*

and *Tordylium*, are called the *Amminea*, *Selinea*, *Angelicea*, *Peucedanea*, and *Tordylineæ*.

(3409.) In the *Amminea* the fruit is laterally compressed.

(3410.) In the *Selineæ*, the fruit on the transverse section appears round, or nearly so, or the mericarpia are but slightly compressed posteriorly.

(3411.) In the *Angeliceæ*, the fruit is compressed at the back of the mericarpia, and furnished with four wing-like margins.

(3412.) In the *Peucedaneæ*, the fruit is compressed posteriorly, and two-winged or dipterous.

(3413.) In the *Tordylineæ* the fruit is compressed posteriorly, and the margins dilated and thickened; but this district is scarcely separable from the preceding.

(3414.) *Ammineæ*. The seeds of *Ammi majus*, the *Bishop's weed*, are bitter, and were once much esteemed as a stomachic. They were also recommended by Matthiolus to remove sterility, but they have long fallen into disuse.

(3415.) *Cicuta virosa*, the *Cowbane*, is a very poisonous plant to men, and some animals, such as kine; although others, such as horses, sheep, and goats, feed on it with impunity. In the moist pastures of Sweden it used to occasion a yearly plague amongst horned cattle, until the cause was pointed out and a preventive suggested by Linneus. When full grown, the odor is so strong that the cows avoid it; but when young, the smell is so faint that they eat it indiscriminately with the other herbage amongst which it abounds. Linneus therefore recommended the graziers to keep their cattle in the upland pastures until the cowbane was well grown, and then they might be driven to the lowlands, as their instinct would prevent them touching the plant; his advice was taken, and their annual losses, which were immense, from that period ceased.

C. maculata is said to possess similar properties with the *Conium maculatum*, for which it might be substituted in medicine.

(3416.) *Apium graveolens*, the common celery, is another illustration of this group. In its wild state it is acrid, and even said to be poisonous; but when cultivated it becomes mild and esculent, and forms one of our most pleasant garden vegetables.

(3417.) *Petroselinum sativum*, the parsley, was once arranged as a species of *Apium*, but it is now considered generically distinct. As its foliage is very similar to that of several other plants, such as *Æthusa Cynapium*, the fool's parsley, which is a rank poison, and grows commonly as a weed in gardens, it would be well, to avoid accidents, that the curled parsley, *P. sativum crispum*, should be alone cultivated for culinary purposes. Parsley affords one among many proofs of the impossibility of dividing esculent from poisonous plants; for, although eatable and innocuous to man, and most other animals, it is said to be a deadly poison to parrots.

(3418.) *Helosciadum nodiflorum*, is the *fool's water-cress*. The leaves bear a great resemblance to those of the true water-cress, for which they have been often mistaken, and, as they are poisonous, untoward accidents have not unfrequently occurred. Indeed, when out of flower, they are with difficulty distinguished. It should therefrom be remembered that the petioles, which are sheathing in all the umbellatæ, are not sheathing in the *Cruciferæ*, the group to which the water-cress belongs.

(3419.) *Ptychotis* (olim *Ligusticum*) *Ajowan* is the *Ajava* or *Ajowa* of Hin-

doostan, and the seeds are there esteemed as a remedy for colic; and, according to Ainslie, are valued as a carminative in veterinary practice.

(3420.) One species of Sium or water-parsnip, viz. *S. Sisarum*, the skirret is cultivated for the sake of its roots, which are sweet and agreeable, and, when boiled and eaten with butter, form a wholesome and pleasant food.

(3421.) *Ægopodium Podagria* is the celebrated gout-wort of the ancients; but, if ever it possessed any arthritic influence, its powers have degenerated in modern times, and it has long fallen into disrepute.

(3422.) *Carum Carui* is the well known and much esteemed Carraway of commerce, the seeds of which are agreeably aromatic, and much used both in cookery and medicine.

(3423.) The common *earth nut*, the tubers of which are sweet and esculent, used to be considered a species of *Bunium*, but it is now placed by De Candolle in the genus Carum. From the farinaceous matter the roots contain they are very nutritive; pigs are fond of them, and in times of scarcity they have been sought after as human food.

(3424.) The *Pimpinellæ* are in general acrid and astringent, and sometimes aromatic plants. *P. Anisum* is the anise of medicine; the seeds and essential oil distilled therefrom are esteemed as carminatives, and are very useful in cases of flatulence. Digestive bread and various kinds of food for weak stomachs are flavoured with anise; it enters also into the composition of several liqueurs and different kinds of confectionery, and its leaves are sometimes made into sauces, introduced into ragouts and cheese, and used as garnish. *P. saxifraga*, the *Burnet* saxifrage, is remarkable for the variations in its foliage, caused by soil and climate, so that the varieties have been mistaken for distinct species, and called *P. major, minor*, and *dissecta*. Its root, which is astringent, is used as a masticatory to relieve the toothach, and in decoction to remove freckles. A species of coccus, from which colouring matter may be procured, infests the root of this plant.

(3425.) The *Bupleura*, are like some of the species of *Hydrocotyle*, remarkable for having simple leaves, in a series in which they are almost universally compound. *B. rotundifolium* is said to be astringent, and used to be employed as a vulnerary. The *Bupleuron* of Theophrastus and Pliny is now unknown.

(3426.) *Seselineæ*. In this group will be found the poisonous œnanthes, one species of which has caused so many fatal disasters. It is now only a few weeks since a gang of convicts, working on the embankments at Woolwich, dug up a considerable quantity of the roots of *Œ. crocata*, and as they are fleshy and have a not unpleasant smell and taste, seventeen of the unfortunate men ate of them. They were all more or less disordered, some extremely ill, and four died from the effects of the poison. Such accidents are of so frequent occurrence, that even while these sheets have been passing through the press a report of another case of poisoning by the same plant has been published by Mr. Froysell, of Knighton, Radnorshire: and in the Medical Botany [xxxv.] will be found condensed details of several more.

Notwithstanding its exceedingly poisonous properties this plant has been used medicinally, and it is said to have been found serviceable in the treatment of *icthyosis* and other obstinate cutaneous disorders. The juice is yellow, and its odour resembles that of vine-blossoms; the roots have been also used as poultices to felons, whitlows, and foul ulcers, as well as a bait to poison rats and moles.

(3427.) Poisonous as are most of the œnanthes, such especially as *Œ. crocata fistulosa*, *Phellandrium*, and *apiifolia*, some, as *Œ. peucedanifolia* and *approximata*, are innocuous, and the roots of *Œ. pimpinelloides* are much esteemed, in many parts, as food. They are replete with a bland farina, have something the flavour of a filbert, and are often sold at Angers, and in other continental markets: but although wholesome when cultivated, they are dangerous when wild.

(3428.) *Æthusa Cynapium*, the fool's parsley, already spoken of, belongs also to this district. Its deleterious properties are said to depend upon the presence of a peculiar alkaloid that has been named *Cynapia*.

(3429.) Along with the preceding deleterious marshy plants are arranged some that grow in dry and often sandy soils, which are innocuous and grateful aromatics, such as the common Fennel (Fœniculum vulgare,) and several species of *Athamanta*, and *Libanotis*. *Ligusticum Scoticum* is also eatable, and often used as a potherb, and *Crithmum maritimum* is the rock samphire, so much sought after and prized as an ingredient in salads, and as a condiment when pickled.

(3430.) *Angeliceæ*. *Archangelica*, *Evangelica*, and *Pseudangelica*, are the three subgeneric names given to the divisions of the old genus *Angelica*. These and the other plants, such as *Selinum*, the moon-wort, included in this district, are innocuous and often very grateful aromatics. Indeed, to their agreeable smell and taste, they owe their laudatory names. In Iceland, Norway, Lapland, and Siberia, the Archangelica officinalis is very much esteemed as an article of diet, and as a condiment to flavour other food. The young shoots are generally employed as they are the most aromatic, and they are eaten either candied or raw, with bread and butter. In more temperate regions the Archangelica is chiefly cultivated for the use of the confectioner; it forms when candied an excellent sweetmeat, and is used in the preparation of some of the most choice liqueurs. Its stalks are occasionally blanched and eaten as celery. Medicinally employed it is a grateful stimulant and stomachic. It was once supposed to be possessed of antipestilential powers; and the Laplanders, who believe that it tends to lengthen the span of life, chew the root commonly after the manner of tobacco, and the Norwegians even mix it with their bread.

(3431.) *Peucedaneæ*. The *Peucedanum* (πευκη δανος) of the ancients, was so called from its yielding a strong-smelling gum-resin, which was formerly much esteemed in cases of hypochondriasis; but, although our *P. officinale* or hog's fennel, has an odour something like turpentine, still it does not yield any resin; whether this may be owing to difference of climate, or the non-identity of the plant to which the old name has been given, is unknown.

(3432.) In this district there are included several plants celebrated for their strong and offensive odours, and from which those substances are procured which in medicine are emphatically called THE fetid gums. Of these *Opoponax Chironium* yields the gum-resin opoponax; *Ferula assafœtida*, and *F. Persica* or *communis*, assafœtida, and sagapenum; and several other species, such as *F. Ferulago* and *glauca*, afford similar but less powerful secretions.

It is physiologically curious that these and other offensive drugs should possess an almost specific influence over hysterical complaints, and remarkable, that, disgusting as are their smell and taste, a very short time not only reconciles people to them, but even renders what at first seemed insufferably nauseous not merely bearable, but pleasant. Thus *assafœtida*, which, to mark the disgust with which it was at first regarded, has received the name of the "Devil's dung,"

Stercus Diaboli forms in many parts of Arabia and Persia not only a medicine, but is employed to give a relish to other less sapid food. And to such an extent do epicures indulge in the use of this luxury, that an intolerable fœtor transpires from every pore, which renders a near approach to their persons, especially by strangers all but impossible. The Banian Indians likewise, who, not using animal food, have recourse to the strongest and most acrid condiments, employ assafœtida liberally in their cooking, and carry pieces of it about with them as bon-bons are carried in Europe, and even rub their mouths with it before meals, to create an appetite.

(3433.) *Ferula Ferulago* was said by Sprengel to be the plant whence *Gum Ammoniac* is procured; others have referred to a species of *Heracleum*, hence named *H. gummiferum*, and others to the *Bubon gummiferum*. But that neither of the above were the sources of Ammoniacum has been long suspected. Indeed, upwards of ten years ago, some specimens were sent to me which had been collected on the 24th of June, 1822, at Yexdeh-kaust, in Persia, by Mr. James Dow, a surgeon, from which it was evident that the plant was one then unknown, but the fragments were in too mutilated a condition to allow a description to be attempted. The memorandum which accompanied the fragments and some specimens of the gum says, "The oasback plant, which yields the gum-ammoniac, grows in great abundance in the neighbourhood of a village named Yexdeh-kaust, about forty-seven miles from Ispahan," in the province of Irak el Ajam, the ancient Parthia. "The plant is about seven feet high, and the root-stake in some near seven or eight inches in circumference. In July, when it has arrived at maturity and the leaves begin to turn yellow, the gum exudes spontaneously from all parts of the plant. The exudation seems, however, to be assisted by a species of horned beetle which frequents the plant, and, puncturing it, thus gives vent to the milky juice that concretes on the stem, and when become solid is collected by the inhabitants for exportation." This account of Mr. Dow's has been since confirmed by Lieutenat Colonel Wright, who, having brought home more perfect specimens, the plant has been described by Mr. Don, in the Linnean Transactions, and called by him *Dorema;* for, although nearly allied to *Ferula* and *Opoponax*, it appears to be generically distinct from both.

Ammoniacum is a stimulating expectorant, and proves very serviceable in pectoral complaints, especially in asthma, peripneumonia notha, and chronic catarrh.

(3434.) *Galbanum* has been in general supposed to be the produce of a species of *Bubon*, hence called *B. Galbanum;* this opinion has however been lately shewn by Mr. David Don to be incorrect: and furthermore, the plant long cultivated for the surreptitious Galbanum-bearer is not even a *Bubon*, but a species of *Melanoselinum*. Hence now called M. decipiens.

(3435.) *Imperatoria Ostruthium*, the master-wort of the old English herbalists, was so named from the many commanding virtues of which it was supposed to be possessed, and its assumed influence over numerous diseases. Its root, which is acrid and bitter, has been recommended as a masticatory to relieve toothach, and many writers on materia medica speak well of it as a febrifuge. Lango even affirms that it has cured agues which had resisted the influence of Peruvian bark.

(3436.) *Anethum graveolens*, the dill, is a well known aromatic, the seeds of which are imported annually into this country from the South of France; for, although the plant will grow in England, our climate is not sufficiently warm to allow it to be successfully cultivated as a crop: as its name imports, it is stimu-

lating and heating; and its seeds are chiefly used as carminatives in medicine, and to flavour some varieties of gin. It is used as a spice, and eaten with their food, by the Cossacks.

(3437.) *Pastinaca sativa*, or the parsnip, is a well known culinary plant. Its roots are large and fleshy, abounding in farinaceous matter and sugar, and hence are very nutritious. They are however too sweet to be agreeable to most palates, and are chiefly eaten with salt fish during Lent. One variety, called the *Coquaine*, which has roots from three to four feet long, and upwards of six inches in circumference, is extensively cultivated in Jersey and Guernsey as fodder for cattle; and perhaps the superiority of the Alderney milk may in part depend upon the rich food the milch cows are supplied with. In the North of Ireland parsnips are used with hops in brewing beer instead of malt. A very good wine may also be made with them, and from it ardent spirit may be distilled.

(3438.) *Zozimia absinthifolia*, the old *Pastinaca dissecta*, has eatable roots, which form a favorite dietetic vegetable in Persia and Turkey. It is there called *Sekakul*, and is esteemed as a stomachic.

(3439.) *Heracleum Sphondylium*, the cow-parsnip, is another very nutritious plant. The Kamtschatdales and Russians eat the young shoots and leaf-stalks, after the rind, which is acrid, is peeled off. They collect large bundles of them, and during drying the peeled stalks become covered with a saccharine efflorescence, which is considered a great delicacy. In Poland and Lithuania a kind of beer is brewed from the stalks thus prepared, and when mixed with bilberries and fermented, the Russians distil a spirit from them, which Gmelin says is preferable to that procured from corn. The young shoots, when boiled, form a delicate vegetable resembling asparagus. Both the root and herb afford nutritious fodder for cattle. Cows, swine, and rabbits, are very fond of it; and horses will eat it, but it does not seem to be so agreeable to them.

(3440.) *Tordylineæ. Haselquistia*, named after the celebrated traveller in the Holy Land, and *Tordylium*, the hartwort, form together this small district, which by Koch is united with the preceding, and their differences are so slight that it is scarcely worth while to keep them separate. The Haselquistiæ are remarkable plants, and supposed by some to be only monstrous forms of Tordylia, to which at any rate they are very nearly allied.

(3441.) *Daucidæ.* The subtypical allies of the carrot (*Daucus*), are distributable into four minor groups or districts, called, from *Siler*, *Cuminum*, *Thapsia*, and *Daucus*, the *Sileriæ*, *Cumineæ*, *Thapsieæ*, and *Dauceæ*; the whole of which are so small as scarcely to demand separation.

(3442.) In the *Silereæ* (or *Silerineæ*) the fruit is compressed at the back part of the mericarps, all the ridges are wingless, and the secondary ones often absent.

(3443.) In the *Cumineæ* the fruit is slightly contracted from the sides of the mericarps, and the ridges all apterous.

(3444.) In the *Thapsieæ* the fruit is posteriorly compressed or nearly round, the lateral primary ridges being placed beneath a flat commissure, and most of the secondary ones expanded into wings.

(3445.) In the *Dauceæ* (or *Daucineæ*) the fruit is round, or but slightly compressed posteriorly; the primary ridges nearly resemble those in the *Thapsieæ*, but the secondary ones are aculeate.

(3446.) The *Silereæ*, by the occasional absence of the secondary ridges, connect this, the multijugate, with the paucijugate series; and, as De Candolle observes, is evidently the transition from the one to the other.

Galbanum officinale, the true galbanum-bearer, belongs to this district, and is a near associate of *Siler*. The gum-resin it affords is a useful antispasmodic, resembling in many respects assafœtida. It is esteemed as an expectorant, and is serviceable in humoral asthma.

(3447.) *Cumineæ*. *Cuminum* and its ally *Trepocarpus*, are the only genera included in this small district. *C. Cyminum* is the *Cummin* of medicine, the seeds of which are warm and stimulating, but their odor is disagreeable, and they are almost entirely confined to veterinary practice. In the north of Europe they are however used as a spice, entering into the composition of ragouts and other made dishes, and are even mixed with the bread and cheese. Combined with resin, they make a warm stimulating plaster.

(3448.) *Thapsieæ*. The deadly carrot (Thapsia) is said by Dioscorides to have been so called from the island of Thapsus, where it abounds, and on which its deleterious properties were first discovered.

(3449.) The *Laser* of the ancients was a gum-resin endowed with, or believed to be possessed of, such important properties, that by the Romans it was valued at its weight in gold. This precious substance was the *Sylphion* of the Greeks, and the parts about Cyrene, whence it was brought, were called the *Regio sylphifera*. Amongst the many miraculous powers attributed to the Laser were those of being able to neutralize the effects of poison, to cure envenomed wounds, to restore sight to the blind, and youth to the aged. So highly was this drug prized, that stores of it were preserved at Rome amongst the treasures of the state; and Pliny says, so great was its value, that Julius Cæsar, when dictator, caused 111 ounces which he found in the public treasury to be sold to defray the expenses of the first civil war. The plant which yielded Laser was called *Laserpitium*, but what plant it was seems to have been always a subject of doubt, and is now wholly unknown. Some antiquaries refer to the *Opoponax chironium*, once called *Laserpitium opoponax*, the juice of which, from its name, *οπος παν ακος*, appears to have been esteemed a panacea or cure-all. Others refer to the *Thapsia Asclepium*, and others believe the Laser to have been nothing more than the assafœtida of modern times. But there would seem to have been several kinds of Laser or Lacer, as the Laser of Hercules, of Æsculapius, of Chiron, of Theophrastus, &c.; and it is not improbable that, as archæologists assert, the word is a corruption of *Lacter*, and that the drug was the concrete milky juice of various plants, some of which are included in the present genus, *Laserpitium*, such as the L. Siler and gummiferum.

(3450.) *Dauceæ*. The carrot (Daucus Carota) is the most important plant included in this small district. It is a remarkable instance of the appetency of vegetables for improvement, and of the effects of culture in ameliorating their condition and rendering them fit for food. The dried carrot contains more than an 8th part of saccharine matter, which, combined with abundance of starch, renders it very nutritious; but its uses in domestic and rural economy are too well known to allow them to be dwelt on here.

(3451.) Smyrniaceæ. The Campylospermous Angelicinæ are distributed into two subtypes, which, from *Caucalis* and *Scandix*, are called the *Caucalidæ* and *Scandicidæ*.

(3452.) In the first or *Caucalidæ* the fruit is multijugate, that is, both the primary and secondary ridges are developed.

(3453.) While in the second, or *Scandicidæ*, the fruit is paucijugate, that is, furnished with primary ridges alone.

(3454.) *Caucalidæ.* The genera included in this subtype are distributed into two smaller groups or districts, called, from *Elæoselinum* and *Caucalis*, the *Elæoselineæ* and *Caucalineæ*.

(3455.) In the *Elæoselinæ* the fruit is cylindrical, slightly compressed at the back of the mericarpia, the primary ridges filiform, and the two lateral secondary ones expanded into wings.

(3456.) In the *Caucalineæ* the fruit is contracted at the sides or nearly round, the lateral primary ridges plane bands, and all the secondary ones expanded or furnished with aculei.

(3457.) *Elæoselineæ.* Elæoselinum is the only genus included in this district, and neither of its two species are known to be possessed of any remarkable properties, or to be applicable to any useful purpose; it is as it were a representation of the *Thapsieæ* among the *Campylospermous Smyrniaceæ*.

(3458.) *Caucalineæ.* The several species of *Caucalis* or Bur-parsley, and *Torilis* or Hedge-parsley, which, with the *Turgeniæ*, form this district, are troublesome weeds, infesting corn-fields, and other cultivated as well as waste lands, but not affording either food or medicine for man, or acceptable fodder for cattle.

(3459.) *Scandicidæ.* This subtype is divided into two districts, called, from *Scandix* and *Smyrnium*, the *Scandicineæ* and *Smyrnieæ*.

(3460.) In the *Scandicineæ* the fruit is laterally compressed or contracted, lengthened, and often beaked.

(3461.) While in the *Smyrnieæ* the fruit is turgid.

(3462.) *Scandicineæ.* *Scandix*, *Anthriscus*, *Chærophyllum*, and *Myrrhis*, are the chief genera associated to form this district, and they are mostly innocuous and often esculent plants. *Scandix Pecten*, the Venus comb, was formerly used as a potherb; but *Anthriscus vulgaris*, the common rough chervil, which bears some resemblance to the culinary chervil, is deleterious; and a case is on record in which some Dutch soldiers who gathered it in mistake for chervil were poisoned by the soup into which it was put. Even the *Chærophyllum sylvestre* or wild chervil, the herbage of which is eatable and occasionally used as a potherb, and which is a favourite food with horned cattle, has poisonous roots. This is a plant of good omen, for as it grows only in rich ground, it is an index of the nature and condition of the soil. Its stems and leaves dye a beautiful green, and its umbels yellow. *C. sativum* is the garden chervil, and in some places much esteemed as an ingredient in soups and salads.

C. temulum, is said to be a very noxious plant, and to cause when eaten vertigo, and a dangerous kind of intoxication. *C. bulbosum* is also said to be deleterious; but Haller affirms that the Kalmucs eat the roots with their fish, both raw and cooked, and commend them as a nutritive and agreeable food.

(3463.) *Myrrhis odorata*, which is esteemed for its pleasant smell, has been long in cultivation, and formerly was much more used than at present. Its leaves were put into salads, and its roots were eaten either boiled or made into tarts or sauces, or candied as a sweetmeat. The seeds are still esteemed in Germany to flavour certain soups; and in the north of England they are employed to perfume and polish oaken floors and furniture.

(3464.) *Smyrnieæ.* A similar group of noxious and innocuous plants are here associated, as have been found in several of the other districts, and of these the most important are the *Prangos pabularia* and *Arracacha esculenta*, as affording

wholesome food; and the *Conium* as an active medicine or fatal poison. The roots of the *Arracacha* form a large proportion of the winter food of the people in Columbia, and many other parts of South America, where they are as much prized as potatoes, carrots, and parsnips, are in Europe ; a fermented liquor is also made from these roots, and ardent spirit procured by distillation. The Prangos of Thibet is supposed to be one of the most productive forage plants in the world.

(3465.) The death of Socrates has conferred such a celebrity on Hemlock, that more plants have contended for the honor of bearing death to the philosopher than cities for giving birth to Homer. The coneion of the ancients was a potent poison administered to those condemned to death by the Areopagus. Theramenes and Phocion, as well as Socrates, were poisoned by it; and although the effects recorded in the Phædo are not exactly in correspondence with those we should look for from our common hemlock, it must be remembered, in the first place, that the difference of a more southern climate will effect the energy of the plant, and secondly, that the historian is not a physician, from whom an exact detail of symptoms could be expected. That the modern Conium is identical with the κωνειον of the Greeks, is rendered probable from its being very common in Peloponnesus, "most abundant (says Sibthorpe) between Athens and Megara," and that the *Cicuta virosa, Œnanthe Phellandrium*, and *Æthusa Cynapium*, which have been occasionally referred to, are not found in any part of the country.

Ælian tells us that when the old men of Ceos had become useless to the state, and tired of the infirmities of age, they invited each other to a banquet, and having crowned themselves as for the celebration of a joyous festival, drank a poisonous juice and terminated their lives together.

Linneus and Lamarck believe this poisonous draught to have been, like the coneion, the juice of the modern *Conium* maculatum or hemlock; while others suppose the fatal beverage to have been a compound of several herbs.

(3466.) The *Conium maculatum* or *spotted* hemlock, is, like others already mentioned, a poison to some animals, but innocuous to others. It is said to be fatal to kine, but that horses, goats, and sheep, may feed upon it without danger; and most brute animals can eat it when dry with impunity, although, whether fresh or dried, it is poisonous to man; yet thrushes will eat the seeds, which are more potent than the leaves.

(3467.) Like many other poisons, Hemlock in regulated doses is a serviceable medicine; it is sedative and alterative; and Störck extols it highly, both as an internal medicine and an external application, in the treatment of scirrhus and cancer : yet much care is required in its administration, as the most untoward effects have been known to follow an over-dose, as well as its absorption from raw surfaces. In the mode, however, in which the extract is commonly prepared, there is not much chance of its doing either good or harm; but if the expressed juice be spontaneously evaporated, it then retains the odor and all the medicinal properties of the recent plant.

(3468.) *Smyrnium Olusatrum* was an ancient potherb, and it is still grown under the name of Alexanders, its young shoots and leaf-stalks, as well as those of *S. perfoliatum*, have an agreeable flavour, something similar to that of celery, by which they are almost superseded in modern gardens. These plants, like the *Atriplices*, seem to have been some of the *Olera atra* of former times, so called from the darkness of their foliage; a peculiarity expressed in the specific name.

(3469.) Coriandraceæ. *Coriandrum*, *Atrema*, *Astoma*, and *Bifora*, are the only four genera that have cœlospermous fruits, and are therefore all that are included in this small type, which comprehends but five known species; and as these are very similar to each other, or at least without any great discrepancies, it is not distributed into any subtypes or districts.

(3470.) *Coriandrum sativum* is the common coriander, the seeds of which are aromatic and carminative, but they form one of the less agreeable spices. They are used in medicine to cover the nauseous taste of senna, as well as to prevent its griping. Feuillée says that in Peru the coriander is used by the natives in such excess to season their meat and other food, that an insupportable fetor arises from most of their dishes. In small quantities coriander-seeds are employed as a condiment in Europe; they are used to flavour some kinds of bread, pastry, and confectionary, enter into the composition of certain ragouts, and form an ingredient in curry-powder.

(3471.) From the preceding summary account of this very important group of plants, it will be perceived that the Angelicinæ differ very much in their properties, some being mild and innocuous, affording abundance of nutritious food, others agreeably or powerfully aromatic, being grateful stimulants and spices, and others again the most potent medicines or deadly poisons.

These facts have been seized on with avidity by objectors to the natural system of arrangement, and blazoned forth as glaring contradictions to the general rule of homomorphous plants being homogeneous also. It should however be recollected that this, like all other general rules, is presumed to admit of certain exceptions; and in the second, it should be proved that the present instances are really such, which latter point is more than questionable: for the homogeneity required in homomorphous plants is not an exact or special similitude, but a general agreement. It does not require that all associated plants shouid have properties precisely the same, both in kind and in degree, but that there should be a general accordance. Now, without wishing to affirm that all the affianced genera are distributed into strictly natural groups, which in this, the infancy of the science, it is highly improbable they should be, still, if it can be shown that in a vast majority of cases the associated genera agree both in structure and in properties, and if in others the deviations can be shewn to be only such as occur in groups known to be strictly natural, as in the different individuals in the same species, or even in the different parts of the same individual; or further, in the same parts grown under different circumstances; or even subjected to the same circumstances, but given to different animals, or to the same animal at different periods of age, or in different states of health, then it must be confessed all such objections are invalid. That the above hypothesis can be verified the present group alone affords abundant proof. *E. g.*, some species of Œnanthe are poisonous, while others are wholesome. Hemlock, which destroys life in men and kine, will fatten sheep, goats, and horses. *Cicuta virosa*, which is a deadly poison to cows and men, may be eaten with impunity by horses, sheep, and goats; and parsley, which poisons parrots, is innocuous to most animals, and a grateful condiment to man. Again, the leaves and stalks of meadow-chervil are innocuous and nutritive, while its roots are deleterious, and the leaves and leaf-stalks of the common celery, which, when they grow wild, are acrid and injurious, when properly cultivated are bland and wholesome. But of such illustrations there might be no end, for such devia-

tions, if so they are to be called, are the deviations of nature, and hence proper to a natural system; but, instead of their being objectionable deviations, they are in strict accordance with the principles of the system, for they depend either upon individual idiosyncracies, or upon the greater or less development of common properties; and when the system of affinities not only associates plants which are generally wholesome in groups distinct from those which are as generally noxious, but likewise indicates most unexpectedly a third series, in which the properties are variable, from the varied development and varied proportions of the common constituents, it not only fulfils but far exceeds its primary intention. But the truth is that the system of natural affinities has done so much more than could have been reasonably expected, that some unreasonable cavillers would require it to reconcile things that are incompatible, and to do, not only what is impossible to be done, but that which would not be desirable even it were to be effected.

RHŒADOSÆ.

(3472.) The *Rosales* not referable to either of the preceding suborders, *Angelicosæ* and *Myrtosæ*, are comprehended in this, the *Rhœadosæ*. It therefore includes all those exogenous or dicotyledonous Angiospermæ in which the perianth is double, and the petals discrete and exserted with the stamens, from the receptacle or thalamus. Hence this group is equivalent to the hypogynous polypetalous dicotyledons of Jussieu, and the thalamiflorous exogenæ of De Candolle.

(3473.) The collective term *Rhœadosæ*, a derivative of *Rhœas*, a well known and normal species, is preferred to the periphrases, *Hypogynous polypetalous dicotyledons*, or *Thalamiflorous angiospermous exogenæ*, not only to avoid unnecessary circumlocution, but because they both tend to convey erroneous impressions. For, notwithstanding the general affinity of the plants associated in the group is freely admitted, and although the *Rhœadosæ* are for the most part either exogenous or dicotyledonous, and many are both, still there are some which are exceptions to the former rule, some to the latter, and others perhaps are neither.

(3474.) But, besides these common collective signs, there are others, which, although less general, are so very frequent in their occurrence, that they may be regarded in some measure as characteristic. Of these the non-adhesion of the torus, when present, either to the ovaries or calyx, and the distinct exsertion of the sepals, petals, and stamens, are the most important, as they strongly contrast the *Rhœadosæ* with the two other contingent suborders, in which they are continually united to each other, and the calyx and disk so often either petaliferous or staminiferous, or both. [1913-6.] Furthermore, the sepals in the Rhœadosæ are most commonly discrete, as well as the petals, and the fruit much more frequently apocarpous than in either of the preceding groups.

(3475.) Hence, selecting the chief differential signs to form a general diagnostic rule, the *Rhœadosæ* may be said to be thalamiflorous, angiospermous, apopetalous exogenæ, or dicotyledons, *i. e. Rosales*, with hypogynous stamens and petals, the latter being discrete, and the disk, when present, not adhering either to the calyx or the germen.

(3476.) The subordinate groups into which the genera here associated have been formed differ much both in number and extent, according to the views of various systematic writers: as, in previous instances, an attempt has been made to reconcile the two extremes, and to combine the advantages of both; for, while the

types are equivalent to the small orders of Brown, De Candolle, and most modern systematists, the sections represent the larger and more comprehensive ones of Linneus and Jussieu. The succession of the groups is also another point of variance, no two authorities being accordant; but it is a matter of very secondary importance; and the course here pursued is the descent previously hinted at [1909-11,] from the confines of the synpetalous syringales, with which the *Vines* and the *Ivies* are related, to the *Celastrinæ*, which are intimately connected with the bordering Euphorbinæ. Some curious analogies will also be traceable in this scheme between the opposite types and sections of the ascending and descending scales, as of the *Acerinæ* with the *Celastrinæ*; the *Rutinæ* with the *Terebinthinæ*; the *Rhœadinæ* with the *Cicerinæ*; the *Ranunculinæ* with the *Rosinæ*, &c.

VITINÆ.

(3477.) The *Vines* and their allies, besides their immediate connexion with the Araliaceæ through *Hedera*, being border groups, like the *Loranthinæ* of the

A. *Swietenia febrifuga*. C. *Swietenia Mahogoni*. (*a*) The fruit. (*b*) The axis, after the separation of the valves. (*c*) A seed. (*d*) The embryo. B. *Vitis vinifera*. Branch, with leaves, fruit, and tendrils. (*a*) Flowers. (*b*) A flower isolated before expansion. (*c*) The same expanded, to shew the petals coherent by their apices before they fall and suffer the anthers to shed their pollen. (*d*) A flower after the corolla has fallen, to shew the disk, the sub-hypogynous stamens, and the pistil. (*e*) Section of the germen, shewing the same parts and the twin ovules. (*f*) Section of the fruit, to shew the two cells. (*g* and *h*) Sections of seeds. (*i*) The embryo.

Angelicosæ, and the *Cucurbitinæ* of the Myrtosæ, indicate their proximity to the *Syringales* by the occasional adhesion of their petals. The analogy which they

bear to the *Cucurbitinæ*, the parallel group of the Myrtosæ, is likewise worthy of remark, for as in the *synpetalous Papayaceæ* the plants are arboreous and the stems destitute of tendrils, while in the *Cucurbitaceæ*, where the petals are sometimes free, the stems are scandent and cirrhose, so in *Leeaceæ* the corolla is synpetalous, and the stem arboreous and excirrhose; while in the *Viteaceæ*, where the petals are discrete, the stems are climbing and furnished with tendrils; the stamens also in both groups are often monadelphous.

(3478.) Differentially considered, the *Vitinæ* or *Ampelideæ* are hypogynous *Rosales* or *Rhœadosæ*, with the petals broad at the base, (occasionally concrete,) and valvate in æstivation. The stamina definite, often monadelphous. The germen undivided, 2 or more celled, with central placentæ, mostly definite ovules, and a single style.

(3479.) The genera included in this section are associated to form three types, which, from *Leea*, *Vitis*, and *Melia*, are called the *Leeaceæ*, *Viteaceæ*, and *Meliaceæ*.

(3480.) Leeaceæ. *Leea* and *Lasianthera*, which together form this small type, are non-scandent shrubs, with irregularly angled branches and opposite leaves, (those towards the ends of the branches are alternate,) petiolate, pinnate, with serrate folioles, and furnished with stipules, but excirrhose. The inflorescence is paniculate or cymose, the peduncles opposite the leaves, and the flowers regular and united.

The calyx is free and 5-toothed, the torus urceolate, the petals 5, alternate with the lobes of the calyx, connate by their ungues, reflexed at their points, deciduous, and valvate in æstivation. The stamina are definite (5), usually monadelphous, opposite the petals, and exserted with them from the outside of the torus, and hence scarcely hypogynous. The anthers are 2-celled, versatile in their position, but not oscillating: the locules are parallel, and dehisce lengthwise by clefts. The germen is 4-6-celled and the cells uniovulate.

The fruit is dry or baccate, formed of 4-6 carpels, which are separable, each being monospermous. The seeds are erect, the albumen cartilaginous and lobed, and the excentric embryo round, acuminate, and curved.

(3481.) Hence, differentially considered, the *Leeaceæ* are excirrhose synpetalous *Vitinæ*, with subhypogynous petals and stamens, the latter being alternate to the former, the germen 3-6-celled, the seeds solitary, the albumen lobed, and the embryo bowed.

(3482.) The *Leeaceæ* are homely innocuous plants, the berries of which, though harmless, can scarcely be considered esculent, and they are chiefly interesting from the union of their petals and the subhypogynous exsertion of their stamens, which indicate them as transitional from the preceding suborders to the present. The root of *Leea macrophylla* is mucilaginous and astringent, and seems likely to become serviceable as a dye-stuff.

(3483.) Viteaceæ. This type, sometimes called *Ampelideæ* or *Sarmentosæ*, is usually combined with the preceding, but their differences are so great as not to justify more than a sectional connexion. Thus limited by the exclusion of the *Meliaceæ*, the *Viteaceæ* are shrubs with sarmentose scandent stems, tumid separable nodi, simple or compound leaves, the lower ones opposite, the upper ones alternate, furnished with stipules, and often with tendrils.

The inflorescence is racemose or paniculate, the peduncles opposite the leaves, and often with their pedicles converted into cirrhi: the flowers are small, green, or yellowish, rarely purple, inconspicuous, regular, and united.

The calyx is small, nearly entire, or with 4-5 teeth, and open during æstivation. The torus is disk-like, the petals (4-5) are free and exserted on the outside of the edge of the disk, alternate with the sepals, broad at the bases, inflexed at their points, and subvalvate in æstivation. The stamens are equal in number to the petals, and exserted from the disk opposite to them. The filaments are distinct or but slightly connate at the base, the anthers ovate, versatile, and oscillating, 2-celled, with opposite parallel locules dehiscing lengthwise. The germen is superior, subglobose, formed of two connate carpels, 2-celled, and each cell 2-ovuled. The ovules are collateral and erect, and exserted from the base of the central column. The style is single, short or none, and the stigma simple.

The fruit is a juicy grape or uva (not a true berry), generally by abortion 1-celled and 4-seeded. The seeds are often by abortion reduced in number, erect, osseous, and, when mature, separating from the placentæ. The albumen is hard and fleshy, the embryo erect, only half as long as the albumen, the radicle taper and inferior, hence next the hilum, and the cotyledons lanceolate, plano-convex, and foliaceous in germination.

(3484.) Therefore, selecting the chief differential characters, the *Viteaceæ* are sarmentose *Vitinæ*, with apopetalous corollæ, subhypogynous stamens opposite the petals, a 2-celled germen, twin collateral ovules, hard albumen, erect embryo, and often furnished with tendrils.

(3485.) *Cissus*, which is both the Greek and Arabic name for the ivy, (*κισσος*, *qissos*,) in botany belongs to a genus of ivy or vine-like plants, which are acid and slightly astringent. The pulpy fruits of several species, as *C. uvifera*, *sycioides*, and *ovata*, are esculent, but not very palatable. The root of *C. salutaris* is said to be serviceable in dropsical complaints, and the leaves of *C. acida* and *C. setosa* are used as topical applications to reduce glandular swellings, or, when heated in oil, to forward suppuration. *C. caustica* is so acrid that it inflames the mouth when the leaves are chewed. *C. glandulosa* and *quadrangularis* are remarkable for the quantity of watery sap their stems contain, and which, on cutting them, pours out in such abundance that they are occasionally resorted to by weary travellers to quench their thirst. The young shoots of this species, as well as those of *C. rotundifolia*, are eaten in India and Arabia as potherbs.

(3486.) *Ampelopsis* is a genus which, as its name imports, bears a great resemblance to the vine. *A. hederacea* is the 5-leaved ivy or Virginian creeper, now so commonly grown in this country, and remarkable for the brilliant red hue its leaves assume in the autumn. This change of colour depends upon the development of a considerable quantity of acid, indeed of so much, that when the leaves are bruised and applied to the skin, they will raise blisters; and hence they have been occasionally employed as cataplasms to relieve rheumatic pains.

(3487.) Few plants have been more vituperated and cherished than the vine (*Vitis*), and it must be confessed that few afford more grateful and refreshing fruit for food, or produce more invigorating and wholesome drinks, notwithstanding the manifold abuses of its fermented juice, and of the ardent spirit distilled

therefrom. The culture of the vine may be traced to very high antiquity, and its growth, and not improbably the preparation of wine, were branches of antediluvian industry, for we read that, immediately after the deluge, Noah planted a vineyard and drank of the wine.

(3488.) There are several species of Vitis that bear eatable fruits, but none are comparable in importance with the common grape-vine, *V. vinifera*. *V. labrusca* and *laciniosa* are cultivated, but the latter as much for curiosity as use, and their hybrids with the former are not practically distinguishable from its proper varieties. The American fox-grape (*V. vulpina*), so called from the peculiar foxy flavour of its fruit, which is not ameliorated by cultivation, is on that account far inferior to the grapes of the Western world, and hence is but little esteemed.

(3489.) Vine-growers enumerate in their catalogues nearly 300 varieties of grapes, of which between fifty and sixty are cultivated in Britain. These are classed according to the form and colour of the fruit; thus, 1st, the round black grapes; 2d, the long black ones; 3d, the round white or green grapes; 4th, the long white or green ones; and, 5th, grapes of any other colours, such as red, roseate, blue, greyish, or variegated in stripes.

(3490.) Of the round black grapes, the Damascus, the black Lisbon, the muscat or purple Constantia, and the black morocco, are the most esteemed: the claret grape is remarkable for its juicy pulp being of a deep purple or blood-colour, while in the others the dark tint is confined to the skin. The Ascalon or black Corinth, called also the grape of Zante, is important, as affording the Corinths or currants of commerce.

(3491.) Of the long black grapes, the Muscadel, the Burgundy, the purple Hamburgh, the black raisin, and black Palestine, are the best.

(3492.) Of the round white grapes, the Amber Muscadine, the Malmsey Muscadine, (which is a variety of *V. laciniosa*,) the white Muscadine, the Pearl-drop, and the white Constantia, are all excellent. The white Corinth or Ascalon is often without pips, and this variety it is which, when dried, is known as Sultana raisins.

(3493.) Of the long white grapes, the White Sokars, the White Muscat, the Morillon or genuine Tokay, the white raisin and others, might be mentioned. The Verdelho, from which Madeira wine is made, is an excellent grape, but the stones should be rejected, as they are said to be deleterious when eaten.

(3494.) Of the fancy grapes, the red Muscat, the blue Tokay, the striped Aleppo, and the variegated Chasselas, are all worthy of cultivation.

(3495.) The grape-vine is believed to be a native of Persia and the neighbouring countries, and to have migrated from the East through Egypt, Greece, Sicily, and Italy, to Portugal, Spain, and France; and even as far north as St. Petersburgh and Stockholm. Grapes are now grown in houses both in Russia and Sweden, but the finest and most luscious fruit is produced in the British vineries. The flavour of our hot-house grape, owing to the care and skill of the cultivators, is said to be far superior to that of any grown either on the European or Asiatic continents. Grapes may be profitably cultivated in the open air, from latitude 21° to 51°; that is, from Schiraz in Persia, to Coblentz on the Rhine. Vineyards were formerly common in England; but, although in some situations, and in low rich soil, and warm defended situations, such as near Battersea, in

Surrey, the crops were tolerably successful, in general, the wine produced from British grapes, even if drinkable in former centuries, when the flavour of Continental wines was less known in England, it is more than probable would not be considered palatable now. Still it must be confessed that accounts are on record of good wine being made from grapes grown in favourable situations. The Duke of Norfolk is said to have had, in 1763, sixty pipes of excellent Burgundy in his cellars at Arundel Castle, the produce of his Sussex vineyards; and the Honorable Charles Hamilton, of Pain's Hill, had, in Miller's time, vineyards famous for their champagne. Miller's Burgundy, which is a hardy grape, was the one here so successfully grown.

(3496.) The Burgundy, modified by soil and situation, is the most common vineyard-grape of France, from Champagne or Marne, to Marseilles or Bordeaux. The best wines of Italy and Spain are also made from grapes of this description; but in both countries many of the larger berried sorts are grown, as being more productive of juice, although the varieties with small berries and an austere taste are the best for wine-making. The sweet wines, such as Malmsey, Tokay, &c. are made from sweet grapes, allowed to become fully ripe. And some of the finest Tokay, and other wines, are made from grapes grown in volcanic districts. Hermitage is made from vines growing amongst the debris of granite rocks; and vines in general affect a dry rubbishing soil, or rather a rich soil with a dry subsoil.

The average quantity of foreign wines upon which duty is paid for home consumption is about seven million gallons per annum; and in 1831, from this source alone, the revenue received 1,575,438*l.* 6*s.* 9*d.*

(3497.) Raisins are not made from any particular grape, but they often differ as much from the mode of preparation as from the kind of fruit that is dried. They are chiefly distinguished in the market according to the places from which they are brought, as the Malaga, the Smyrna, &c. Between 7 and 8,000 tons of raisins are annually imported into this country, besides a large quantity of undried grapes; and nearly 600 tons of currants, the duty upon the last of which alone, in 1828, amounted to 261,300*l.*

(3498.) The uses and the abuses of wine, and the value of grapes, whether fresh or dried, are too well known to be made subjects for discussion here: but, besides the above important products and educts, the vine affords vinegar as well as alcohol; and yields malic, citric, and tartaric acids, with abundance of supertartrate of potash, all of which are grateful articles of diet and useful medicines. The vine is known to attain a great age and a very large size; several in this country are above 100 years old, and have been trained over 116—137 square yards, bearing upwards of 2000 pounds weight of fruit per annum. The trunks of others have been known to be above four feet in circumference, and to have been sawn into planks 15 inches broad. When thus old and large, its timber is one of great durability.

(3499.) MELIACEÆ. *Humirium*, *Melia*, and *Cedrela*, with *Flindersia*, and their allies, are the normal genera of three small groups, associated to form this type. Some of them have been elevated to the rank of separate orders, but they seem sufficiently distinguished when recognized as subtypical groups. Their chief differential characters are the following.

(3500.) In the *Humiridæ* the stamens are numerous and simply monadelphous,

the connectivum dilated, the petals quincuncial in æstivation, the ovules pendulous, the fruit 5-celled, or fewer from abortion; the seeds with fleshy albumen, the embryo oblong, straight and slender, the juices balsamic, but the coriaceous leaves dotless.

(3501.) In the *Melidæ* the stamens form a long-toothed tube, within which the anthers are adnate, the connectivum is undilated, the petals valvate in æstivation, the fruit is several celled, and the seeds exalbuminous and wingless.

(3502.) In the *Cedrelidæ* the monadelphous stamens and pistils are stipitate, the stipe glandular, the locules several and many-seeded, and the seeds sub- or ex-albuminous and winged, and the leaves punctate or impunctate.

(3503.) Collectively described, the *Meliaceæ* are tropical trees or shrubs, with alternate exstipulate leaves, either simple or compound.

The inflorescence is terminal or axillary, and either in racemes or panicles. The flowers are regular and united.

The calyx is formed of 4-5 sepals, more or less coherent. The petals equal in number to the sepals, and exserted alternately to them, hypogynous, and with broad ungues, either connivent or coalescent at the base, and valvate, rarely quincuncial or imbricate in æstivation. The stamina double the petals, rarely equal to them in number, or 3 or 4 fold. The filaments are monadelphous, often forming a tube with a toothed extremity bearing the anthers adnate within its faux. The disk is frequently highly developed, the ovarium is formed of several connate carpels, the placenta often central, the ovules definite, and the styles more or less discrete or coalescent.

The fruit is either baccate, drupaceous, or capsular; many-celled, or by abortion 1-celled, with a dissepiment in the middle of each valve. The seeds are either winged or wingless, albuminous, or exalbuminous, and the embryo inverted, 2-lobed but variable in form.

(3504.) Hence, differentially considered, the MELIACEÆ are excirrhose non-scandent *Vitinæ*, with mostly monadelphous stamens, the filaments forming an antheriferous tube, or, when free, with the seeds winged and the embryo inverted.

(3505.) *HUMIRIDÆ. Humirium balsamiferum* is the *Oumiri* of Guiana and Cayenne. Its bark, which is thick, abounds with a red fluid resin, resembling styrax in smell, and called balsam of *Oumiri*. It becomes a brittle transparent solid on exposure to air, and when burned it diffuses a very agreeable odour.

According to Aublet, it possesses similar medicinal properties to the balsam of Peru. The negroes of Guiana cut the bark in strips and use them as flambeaux. They also employ the timber as a building material, and from its colour the Creoles call it 'red wood.'

(3506.) *MELIDÆ.* The genera here associated are distributable into two subtypical districts, called, from Melia and Trichilia, the *Melieæ* and *Trichilieæ*.

(3507.) In the *Melieæ* the cotyledons are flat and foliaceous, and the leaves mostly simple; while

(3508.) In the *Trichilieæ* they are thick and fleshy, and the leaves pinnate or trifoliate, rarely simple.

(3509.) *Melieæ. Canella alba*, the *Winterana Canella* of Linneus, is the plant which affords the false Winter's or Canella bark, that, as a grateful tonic, has now almost superseded the use of the *Drymis Winteri*, or true Winter's bark, to which it is indeed superior. The bald-pate pigeons of the Caribbee Islands and the

South American continent feed greedily on its berries, and their flesh becomes impregnated with its peculiar spicy flavour. *C. axillaris* yields a bark similar in its properties to the foregoing.

(3510.) *Melia Azaderachta* and *M. Azedarach* are the bead-trees, so called from their seeds being often strung as necklaces and rosaries. The *Azadaracht*, mentioned by Avicenna, was a poisonous plant now unknown; but the pulp of the fruit of the modern Azedarach and Azaderacht, are said to be both deleterious. In Ceylon it is mixed with grease to kill dogs, but, except in large quantities, it does not seem to be injurious to man, (according to Turpin,) for children eat the fruit, and birds feed upon it with impunity; indeed, Turpin says, he has seen dogs eat it without injury, while M. Tournon records the case of a child poisoned by eating two or three of the seeds. The root of *M. Azedarach* is bitter and nauseous, and has been employed as a vermifuge. *M. Azaderachta*, the *Margosa* or Neem-tree, is said to possess febrifuge properties, and a kind of toddy is procured by tapping its trunk, which the Hindoo doctors esteem as a stomachic. The pulp of its fruit, which is about the size of a small olive, is remarkable for yielding a fixed oil that is said to be stomachic, but is chiefly valued for burning, and other domestic purposes.

(3511.) *Trichilieæ*. The *Trichiliæ* have strong-smelling juices, some of which, as *T. odorata* and *moschata*, the musk-woods, are pleasant, and used as perfumes. The fruit of *T. speciosa* yields a fragrant oil, used as a liniment to relieve the pains of chronic rheumatism, and the seeds of *T. emetica* mixed with those of *Sesamum*, are employed in Arabia to cure the itch, and by the Arabic women in a wash for cleansing their heads.

(3512.) *Guarea grandifolia* or *Trichilioides*, has, like the *Trichiliæ*, a very fragrant wood, which is used as a perfume instead of musk. It has sometimes, in lack of other timber, been made into staves for puncheons, but, from imparting its bitterness and smell to the rum, it is unfit for such a purpose, as it spoils the liquor. Its bark is both purgative and emetic, and that of *G. purgans* is also used in Brazil as a cathartic.

(3513.) *Carapa Guianensis* is the *Y-Andirhoba*, from the seeds of which the natives of Guiana extract an oil which they call carapa, much in request for anointing the body in order to prevent the attacks of insects, and to shield them from the malevolent influence of a very humid atmosphere. The oil is as thick as butter.

(3514.) *Cedrelidæ*. This subtype appears to require separation into two districts, for *Flindersia*, usually included among the *Cedreleæ*, differs from them in several important particulars, such as the movable dissepiments of its capsule, which is separable into 5 single segments, the erect position of the ovules, and its resinously glandular leaves.

(3515.) Hence the *Flindersieæ* are punctate *Cedrelidæ*, with movable dissepiments;

(3516.) And the *Cedreleæ* impunctate ones.

(3517.) *Cedreleæ*. *Cedrela odorata* is the base cedar of the West Indies; its leaves and fruit have a nauseous smell, resembling that of assafœtida, but its wood is fragrant like cedar, whence its name. Its timber is soft, and its trunk so large, that canoes are made of it forty feet long by six feet wide; it is also valued in carpentry, as it is easily worked; and its bitterness prevents it being destroyed by

insects; but it is unfit for the cooper's use, as, like the Guarea, it imparts its bitter taste and smell to the liquors put into casks made of it.

(3518.) *C. Toona* and *C. febrifuga* are bitter and tonic, and their barks are held in much esteem for the cure of intermittent fevers. They likewise yield excellent timber.

(3519.) *Swietenia febrifuga* has a very bitter and astringent bark, and it has been proposed as a substitute for cinchona; but the report of Dr. Ainslie is unfavorable as to its use: he says, when given to the extent of four or five drachms in twenty-four hours, it deranges the nervous system, and occasions vertigo and subsequent stupor. Its timber is very hard and durable, and in the East Indies it is preferred on this account for the wood-work of the religious temples. It is also used as a red dye.

(3520.) *S. Mahogoni* is well known for the value of its timber, which is hard, durable, and beautifully veined: from the abundance in which it is obtained from the West Indies it has almost superseded the use of oak, walnut, and other European woods, for ornamental purposes. The Honduras mahogany is less beautiful than the Jamaica wood: and it is not improbable that they are the produce of trees specifically distinct. About 20,000 tons of mahogany are annually imported into this country; and a few years since Messrs. Broadwood gave the enormous sum of 3000*l.* for three logs of mahogany, all cut from a single tree. The duty on mahogany produces a revenue of nearly 60,000*l.* per annum.

(3521.) *Oxleya xanthoxyla* is the yellow wood-tree of New South Wales; and *Chloroxylon swietenia*, a native of the East Indies, is also valued for its timber, which is nearly as hard as box-wood.

(3522.) *Flindersieæ. Flindersia Australis* and *F. Amboinensis* are both fine trees, the timber of which is said to be little, if at all, inferior to mahogany; the fruit of the latter, which is very rough, is used in Amboyna by the natives as a rasp. It is the *Arbor radulifera* of Rumphius.

CISTINÆ.

(3523.) The several types here associated are distributable into two subsections, called, from St. John's wort (Hypericum), and the rock-rose (Cistus), the *Hypericianæ* and the *Cistianæ*.

(3524.) The *Cistinæ*, collectively considered, are *Rhœadosæ*, with punctate or impunctate leaves, imbricate sepals, imbricate or contorted petals, symmetrical germen formed of several connate carpels, and parietal or sub-parietal, rarely central placentæ.

(3525.) Selecting the chief differential characters, the *Hypericianæ* are *Cistinæ*, with in general punctate leaves, petals mostly contorted, rarely imbricate in æstivation, the placentæ subcentral and seeds exarillate, the embryo straight, and the cotyledons entire;

(3526.) While the *Cistianæ* (though in some cases scarcely separable,) are impunctate *Cistinæ*, with the petals mostly imbricate, rarely contorted in æstivation, the placentæ parietal, the seeds in general arillate or appendiculate, the embryo variable, and the cotyledons foliaceous.

(3527.) The genera included in the subsection *Hypericianæ* are distributable into three types, called, from *Garcinia*, *Hypericum*, and *Frankenia*, the *Garcinia-*

cea, Hypericaceæ, and *Frankeniaceæ*, to which may be added, the *Sauvagesidæ*, that form the transition from this subsection to the next, with which, from their close relationship to the Violaceæ, they are not unfrequently combined.

A. *Hypericum perforatum.* (*a*) Flower deprived of the corolla, to shew the stamina and pistils. (*b*) The fruit, formed of 3 connate carpels. (*c*) Transverse section, to shew the introflexed margins of the valves and the subparietal placentæ. (*d*) Seed. (*e*) Section of ditto, to shew the straight embryo. (*f*) The embryo isolated.

B. *Garcinia Cambogia.* (*a*) A flower. (*b*) Ovary with the peltate stigma. (*c*) Transverse section of ditto, to shew the many cells and central placentæ. (*d*) Longitudinal section of the germen. (*e*) Entire fruit. (*f*) Section of ditto. (*g*) Seed during germination. (*h*) Seed with its arillus.

C. *Frankenia pulverulenta.* (*a*) A flower. (*b*) Ditto, deprived of calyx and corolla, to shew the hypogynous stamens and the pistil. (*c*) Fruit. (*d*) Section of ditto, shewing the introflexed margins of the valves and subparietal placentæ. (*f*) Seeds.

(3528.) GARCINIACEÆ (or Guttiferæ.) The *Mangostan* and its typical allies are trees or shrubs, occasionally of parasitic growth, and abounding in yellow resinous juices. The leaves are opposite, coriaceous, entire, with short petioles, a strong midrib, and often parallel lateral costulæ extending to the margin, stipulæ 0.

The inflorescence is in general axillary and racemose, but sometimes terminal and paniculate, or crowded and lateral. The flowers, usually numerous, are either united or separate, monœcious, diœcious, or polygamous, and in colour white, red, or yellow.

The calyx is 2-6-sepaled, often persistent, roundish, membranaceous, frequently irregular and coloured, and imbricate in æstivation, the sepals being

cruciately disposed, and the outer ones the shortest. The petals 4-6 (rarely 8-10), are hypogynous, free, and either opposite to the sepals or alternate with them, and passing gradually from the condition of a corolla to that of a calyx. The stamens are numerous, indefinite, rarely definite, and hypogynous in their exsertion. The filaments are variable in length, and either free or connected into one or more bundles. The anthers are adnate, linear, 2-celled (rarely 1-celled, and immersed in the fleshy disk as in *Havetia*), and dehiscent lengthwise by chinks, rarely by pores at the apex, usually introrse, but extrorse in the *Chrysopidæ*. The disk is fleshy, and in *Chrysopia* 5-lobed. The germen is superior and free, 2-8-celled, rarely 1-celled as in *Calophyllum*, and the cells 1- or many-ovuled. The style none or very short, and the stigma peltato-radiate or many-lobed, with the style cleft.

The fruit is dry or succulent, either baccate, capsular, or drupaceous; 1 or many-celled, 1 or many-seeded, and either dehiscent or indehiscent. The pericarp is thick and many-valved, the valves often introflexed at their margins, forming more or less perfect dissepiments bearing the placentæ, which are sometimes parietal, sometimes central, and sometimes both central and free; in the unilocular fruits the seeds are few, in the multilocular ones the cells are either mono- or polyspermous. The seeds are wingless, usually arillate, and often nestling in pulp. The spermoderm is thin and membranaceous, the embryo straight and exalbuminous, the radicle variable in its direction, and the cotyledons thick and entire, and often inseparable from each other.

(3529.) Hence, differentially considered, the *Garciniaceæ* are resiniferous *Cistinæ* or *Hypericianæ*, with coriaceous, opposite, simple, exstipulate leaves, usually persistent irregular sepals, numerous unequal stamens, adnate linear anthers, central or sub-central placentæ, and wingless seeds.

(3530.) The *Garciniaceæ* are distributed by De Candolle into four secondary groups or subtypes, called, from *Chrysopia*, *Calophyllum*, *Garcinia*, and *Clusia*, the *Chrysopidæ*, *Calophyllidæ*, *Garcinidæ*, and *Clusidæ*.

(3531.) The *Chrysopidæ* are *Garciniaceæ*, with indehiscent many-celled fleshy fruits, the cells 1 or many-seeded, the anthers extrorse, and the filaments connate.

(3532.) The *Calophyllidæ* are *Garciniaceæ*, with indehiscent 1-celled drupaceous or baccate fruits, the seeds few, and either nestling in pulp or enclosed within a dry pericarp.

(3533.) In the *Garcinidæ* the fruit is dry or fleshy, indehiscent, many-celled, and the cells 1-seeded.

(3534.) In the *Clusidæ* the fruit is capsular and dehiscent, many-celled, and the cells 1 or many-seeded.

(3535.) *Chrysopidæ*. This subtype, called *Symphoniæ* by De Candolle, from *Symphonia*, an obsolete name for *Chrysopia*, is, as he observes, closely related to the *Meliaceæ* of the preceding section. Indeed, *Canella*, which, from its tubular stamens, seems properly to belong to the *Melieæ* [§ 3509], is by him included in this group.

(3536.) *Monorobea coccinea*, an ally of *Chrysopia*, and, like it, formerly considered a species of *Symphonia*, is the *Coronoba* of the Caribbees, who use its resinous juice as a cement to fix the iron heads on the shafts of their arrows, and also to cause the poison to adhere to the barbs. The Creoles employ it instead of

tar to protect their boats and cordage, and mixed with other resins to make flambeaux.

(3537.) *Calophyllidæ.* The *Calophylla,* as their name implies, are trees with remarkably beautiful leaves. The different species, particularly *C. Inophyllum, Tacamahaca, spectabile,* and *Calaba,* yield resinous juices, which are known in commerce as balm of *Calaba,* and at least one of the kinds of *Tacamahaca.* The flowers of these plants are remarkable for their fragrance, and an oil is expressed from their seeds which is used for burning; that from *C. Calaba* is also eatable. The nuts of *C. spectabile* and *spurium* are esculent, but those of *C. Inophyllum,* although at first sweet, have subsequently so bitter a flavour as to be far from agreeable. Its bark, as well as that of *C. spectabile,* is made into ropes in the East Indies, and the timber of *C. Calaba* is said to be serviceable in works not exposed to the weather.

(3538.) *Garcinidæ. Mammea Americana* is the mammee or wild apricot of the West Indies and the American continent. The fruit is large, about the size of a cannon-ball, and covered by a double rind, the outer tough and leathery, the inner fine and membranous. The flesh, which is firm and of a bright yellow, has a singularly pleasant taste and very fragrant smell, but the skin and seeds are very bitter and resinous. It is either eaten fresh, or cut into slices with wine and sugar, or made into a preserve. In Martinique the flowers are distilled in spirit, to which they impart their flavour and form a liqueur called "eau-Creole." Swartz remarks that the trees which bear united flowers are very lofty, but that the stamineous trees are much smaller, and have been mistaken for distinct species. They abound in resinous juices, which are used to destroy the chiggers, those troublesome little insects that infest the feet and burrow beneath the toe-nails, causing much pain and inconvenience; and the wood is esteemed excellent as timber.

(3539.) *M. Africana* is the African mammee, the fruit and resinous secretions of which very closely resemble those of the American species, and are, as well as the wood, applied to many useful purposes.

(3540.) *Pentadesma butyracea* is the butter or tallow-tree of Sierra Leone. The fruit is large, nearly as big as a child's head, and gives out when cut an abundance of yellow grease or semi-concrete oil, which the natives mix with their food, but it is not used by the settlers on account of its strong turpentine flavour. Don says the country butter brought to the market of Free-town is believed to be made of the fatty juices of this tree.

(3541.) *Garcinia Mangostana* is a native of the Molucca Islands, but it is now cultivated in various parts of the East Indies, Java, and Malacca, where it is held in high esteem on account of its fruit, which is affirmed to be one of the most delicious and richest in the world, and withal so wholesome, that a great deal may be eaten without inconvenience: and it is one of the few that sick persons may indulge in without scruple. It is about the size of an orange, crowned with a peltate stigma, with a rind like that of the pomegranate, and consisting within of a soft juicy pulp, in which the flavour of the grape and the strawberry are combined. The dried bark is astringent, and is used in cases of dysentery, and in decoction as a wash for ulcerated sore throats; and the Chinese dyers value it as a mordaunt for black.

(3542.) *Garcinia cornea* is the horn-wood tree of Rumphius, so called from

the extreme hardness of its timber, which when old is too hard to work. When young, however, it is used in building, and for making handles for knives and tools.

(3543.) *Garcinia Cambogia* [§ 3527, B,] yields the well known and valuable gum-resin called gamboge, from *Camboja* or *Cambodge*, the name of the East Indian province whence it is chiefly procured. The tree is large and handsome, the fruit is eatable, succulent, pulpy, and sweet; and as in the East Indies it is believed to be a provocative of appetite, it is much esteemed, and enters into the composition of many sauces. The resinous juices are obtained by wounding the bark, when they exude, and becoming concrete on exposure to air, the small lumps, the *gummi-guttæ* of commerce, are collected for sale. Gamboge is used medicinally both in the East Indies and in Europe; it is a valuable and powerful cathartic, and has but little taste. Its chief consumption is, however, as a yellow pigment.

(3544.) Several species of *Stalagmites*, such as *S. pictorius*, *Cambogioides*, *Cochinchinensis*, and *elliptica*, abound, like the *Garciniæ*, with yellow resinous juices, which, when collected, are often substituted for the genuine gamboge, from which they differ very little, if at all, in properties. The fruits of most of the species, especially of *S. dulcis* and *Celebica*, are eatable, but very much inferior to the Mangostans.

(3545.) *Garcinia umbellata* of Roxburgh is a deviating species; its sepals and petals are said to be connate, and thus, like the synpetalous Leeaceæ, it shews the proximity of this group to the Syringales.

(3546.) *Clusidæ*. The *Clusiæ* are handsome trees, with elegant red, white, or yellow blossoms, but they are chiefly remarkable for their mode of radification. The seeds are invested with a glutinous pulp like those of the mistletoe, and, like them, are lodged on the branches or in the hollows of trees, or deposited in the crannies of barren rocks, where they meet with but scanty sustenance. When therefore the plants have increased in size, they send roots out of the holes in which during their infant state they had lodged, and these hang like pendents from the boughs of lofty trees or traverse the sides of rocks, until they reach the soil, from which a supply of nourishment may be obtained more plentiful and more in proportion to the necessities of the growing plants. These accessory roots have been measured upwards of forty feet in length.

These trees abound in tenacious balsamic juices, which in the West Indies are esteemed as vulneraries, especially in veterinary practice. This liquid resin is also used instead of pitch or tar, and for painting boats.

(3547.) The *Tovomitæ* are, like the *Clusiæ*, resiniferous, and the bark of *T. fructipendula* is used by the Peruvians to dye linen of a reddish-purple colour.

(3548.) Hypericaceæ, [§ 3527, A.] *Hypericum* and its typical allies are herbs, undershrubs, shrubs or trees, mostly abounding in resinous juices, or beset with glands. The stems are nodoso-articulate, and the internodia round or tetragonal. The leaves opposite, simple, entire, very seldom alternate or crenate, either sessile or shortly stalked, covered with black or pellucid dots, rarely impunctate, and without stipulæ.

The inflorescence is terminal or axillary, but mostly in terminal dichotomous cymes. The flowers are regular, united, in general yellow, either pedunculate or sessile, and either foliose or naked, but mostly furnished with bracteæ.

The sepals 4-5, are more or less coherent or wholly distinct; persistent, dotted

or furnished with glands, and usually unequal in size, the 2 outer being smaller than the 2 or 3 inner ones. The petals (4-5) are alternate with the sepals, with a twisted æstivation, and commonly oblique venation, but sometimes nigro-punctate. The stamina are many, often indefinite, and connate by their filaments, forming several fasciculi, rarely free or monadelphous (as in *Lancretia*.) The filaments are long, thin, and straight, and the anthers small, yellow, and versatile. The germen is superior, formed of 3-5 connate carpels; the placentæ central or subcentral, and many-ovuled. The styles several, filiform, generally free, rarely connate, and the stigmata simple or occasionally capitate.

The fruit is capsular or baccate, many-valved and many-celled, in the first case dehiscent, in the latter indehiscent. The placentæ are central or many-parted, and attached to the margins of the introflexed valves. The seeds are small, numerous, (seldom solitary, as in some species of Vismia,) and commonly terete, rarely flat. The embryo is straight and exalbuminous, the radicle inferior, and the cotyledons entire and foliaceous during germination.

(3549.) Hence, differentially considered, the *Hypericaceæ* are resinous or glanduliferous *Hypericianæ*, with opposite punctate leaves, many stamens, connate filaments, versatile anthers, and styles filiform and mostly free.

(3550.) The genera here associated are distributable into 3 subtypes, called, from *Eucryphia*, *Vismia*, and *Hypericum*, the *Eucryphidæ*, *Vismidæ*, and *Hypericidæ*.

(3551.) The *Eucryphidæ* are arboreous or fruticose *Hypericaceæ*, with petiolate leaves, flowers solitary and axillary, or disposed in terminal cymes; the fruit capsular, and the seeds flat and winged.

(3552.) The *Vismidæ* are fruticose *Hypericaceæ*, with stalked leaves, terminal foliose inflorescence, baccate fruit, and taper seeds.

(3553.) The *Hypericidæ* are fruticose or herbaceous *Hypericaceæ*, with usually sessile leaves, axillary or terminal corymbose inflorescence, capsular fruit, and the seeds taper.

(3554.) *Eucryphidæ.* These three subtypes form interesting gradations from the chiefly arboreous Garciniaceæ to the suffruticose Frankeniaceæ, verging towards the *Cistinæ*, which, in general, are herbaceous: and they likewise afford examples of a similar transition from the succulent fruits of the preceding type to the dry capsular ones of those which follow, especially with those of the next subsection.

(3555.) The several species of *Eucryphia*, *Carpodontos*, and *Cratoxylon*, are noble trees. The timber of the latter is remarkable for its strength and hardness.

(3556.) *Vismidæ.* The *Vismiæ* or wax-trees yield on incision an abundance of yellow resinous juice, resembling that afforded by the different species of Garcinia and Stalagmitis, and which it is said possesses cathartic properties similar to gamboge, for which it might be substituted. Indeed, the concrete gum-resin procured from V. Guianensis is known in the markets under the name of American gamboge.

(3557.) *Hypericidæ.* The *Tutsan* or *Androsæmum officinale* was once much esteemed as a vulnerary, its leaves being applied to fresh wounds; and hence its English name, which is a corruption of *toute saine*, or all-heal. Its capsule is fleshy, shewing the connexion of this subtype with the baccate *Eucryphidæ*.

(3558.) The several species of Hypericum or St. John's wort have handsome yellow flowers, and many are very ornamental plants in shrubberies. They are

resiniferous, and in general have a strong odour and astringent bitter taste. Hence some, as *H. connatum, lanceolatum,* and *perforatum,* have been used in gargles and lotions. *H. laxiusculum* is reputed in Brazil to be an antidote to the bites of poisonous serpents; and in Russia *Hypericum dubium* is employed as a defence against canine madness, but it is a remedy more than doubtful. *H. laricifolium* is employed in Quito to dye wool of a yellow colour. H. perforatum is the *Fuga dæmonum* of the old herbalists, and is the plant formerly so much in repute for its supposed influence in conjurations and enchantments; and even now the French and German peasants gather it with great ceremony on St. John's day, believing it to be a preservative against thunder; and the Scots formerly carried it about their persons as a charm against witchcraft.

(3559.) FRANKENIACEÆ. These plants are shrubs, undershrubs, or herbs, with simple or branching stems, and opposite, alternate, whorled or crowded leaves, entire, ciliate, or toothed; stipulate, or when exstipulate, amplexicaul, with the stem-clasping membrane, usually glanduliferous; and the stipules, when present, commonly fringed. The inflorescence is terminal or axillary; when the latter, the peduncles are 1-flowered, when the former, racemose; and the flowers are united and regular, [§ 3527, c.]

The calyx is formed of 4-5 sepals, erect or spreading, and united at the base into a furrowed tube, or free; permanent, equal, (rarely unequal,) and lanceolate or linear acute. The petals are equal in number to the sepals, and exserted alternately with them; sometimes unguiculate. The stamens, when equal in number to the petals, are alternate with them. When double, the supernumerary ones are opposite. The filaments are filiform, or very short. The anthers are roundish, linear, or elliptical, bursting laterally by two pores at the apex, seldom at the base. The ovary is free, 1-celled, and many-ovuled; the style filiform, and the stigmata simple, bifid, or trifid.

The fruit is an ovato-oblong somewhat 3-cornered capsule, 2-3 valved, 1-celled, or incompletely 3-celled from the introflexion of the margins of the valves, which are placentiferous on both sides, and the placentæ polyspermous. The seeds are small, and the embryo straight in the middle of the albumen, with a short radicle pointed towards the hilum, and flat foliaceous cotyledons.

(3560.) Selecting the chief differential characters, the *Frankeniaceæ* are non-resinous *Hypericianæ* with definite stamens (5-10), a 1-celled capsule, with septicidal dehiscence, and parietal or subparietal placentæ.

(3561.) The genera here associated are distributable into two subtypes, named, from *Frankenia* and *Sauvagesia,* the *Frankenidæ* and *Sauvagesidæ.*

(3562.) In the *Frankenidæ* the calyx is synsepalous and tubular, the petals with claws the length of the sepals, and the stamens six.

(3563.) In the *Sauvagesidæ* the sepals and petals are spreading exunguiculate, usually furnished with an urceolus or nectary, and the stamens 5-7, rarely, as in some *Luxemburgiæ,* indefinite.

(3564.) The *Frankenidæ* are innocuous plants, possessed of no very remarkable properties. Some of the *Sauvagesidæ* are mucilaginous. *S. erecta,* which is the *Yaoba* of the Caribs, has been used as an application to sore eyes; and also administered internally in cases of irritable bladder. Its leaves, as well as those of *S. Adima,* have been substituted for spinach.

(3565.) *Cistianæ.* This subsection includes 7 types, which, from *Viola, Drosera,*

Cistus, *Bixa*, *Flacourtia*, *Marcgravia*, and *Tamarix*, are called the *Violaceæ*, *Droseraceæ*, *Cistaceæ*, *Bixaceæ*, *Flacourtiaceæ*, *Tamaricaceæ*, and *Marcgraviaceæ*.

A. *Parnassia palustris.*

(*a*) Section of a flower, to shew the petals, germen, and nectaries.

(*b*) Fruit, with persistent calyx and nectaries.

(*c*) Section of the fruit.

(*d*) Seed, with part of the testa removed to shew the situation of the embryo.

(*e*) Transverse section of the same.

B. *Dionæa Muscipula.*

(*a*) Flower.

(*b*) Fruit with persistent calyx.

(*c*) Transverse section of ditto, to shew the many seeds.

(3566.) The Violaceæ are herbaceous, suffruticose or shrubby plants, with alternate, rarely opposite simple leaves, involute in vernation, petiolate and furnished with stipules, which are marcescent, and often foliaceous.

The inflorescence is axillary but various in mode, the flower pedunculate, erect or drooping, bibracteolate, regular or irregular in form, and united. The calyx is free, formed of 5 sepals, equal or unequal, usually with membranous margins, free or connate below, and imbricate in æstivation. The petals are 5, alternate with the sepals, and hypogynous in their exsertion; usually marcescent and convolute in æstivation. Sometimes they are equal, at others unequal, when the lower petal is labellate and furnished with a spur or hollow at its base. Sometimes there is a staminiferous urceolus, or hypogynous disk, and sometimes a filiform nectary. The stamens are definite (5), alternate with the petals. The filaments are dilated at the bases and extended beyond the anthers, two generally in the irregular flowers, furnished with nectarious glands or basal appendages, included within the spur. The anthers are 2-celled, placed at various elevations on the filaments, but never terminal, and open inwards by longitudinal chinks. The ovary is free, formed of three connate carpels, 1-celled, with three parietal placentæ, one in the middle of each valve, and opposite the external petals; and many-seeded, rarely 1-seeded by abortion. The style is persistent, usually declinate, perforated, and recurved at the top, and therefore the stigma is somewhat lateral.

The fruit is a 3-valved capsule, the valves in general dehiscing elastically, and from the apex to the base. The seeds, usually many, have their three coverings very distinct from each other. The outer one is membranous, more or less

thickened towards the hilum, forming a caruncle; the second is brittle and crustaceous, and the inner one very thin, adherent, and usually dotted brown in the vertex. The albumen is fleshy, the embryo straight, in the axis of the albumen, with the radicle towards the base of the seed; the plumula inconspicuous, and the cotyledons usually flat.

(3567.) Hence (excluding the *Sauvageæ,*) the *Violaceæ,* differentially considered, are stipulate *Cistianæ*, with five distinct petals, definite stamens, filaments elongated beyond the anthers, a single style, narrow parietal placenta and erect embryos.

(3568.) The genera here associated are distributable into two subtypes, which, from *Viola* and *Alsodea,* are called the *Violidæ* and *Alosodidæ.*

(3569.) In the *Violidæ* the sepals are in two series, three outer and broader, and two inner and narrower. The petals are five and unequal, and the stamens free, and with dilated filaments.

(3570.) In the *Alsodidæ* the petals are equal, the stamens usually connected at the base, or exserted from a cup-like nectary.

(3571.) The analogy, if not affinity of the *Violaceæ* with the Passifloraceæ, is noticeable: some, as *Calyptrion*, and several *Noisettiæ*, have even twining stems; but, besides the difference in the exsertion of the stamens, the anthers in the *Violaceæ* are adnate to the middle of the filaments, instead of being, as in the *Passifloraceæ*, versatile, and fixed to the filaments by their middle.

(3572.) *Alsodidæ.* The bark of *Gonohoria Cuspa* is esteemed in New Granada as a febrifuge; it is used both in powder and decoction. And the leaves of *G. Loboloba*, which are mucilaginous and have an agreeable flavour, are esculent; and the negroes of Rio Janeiro eat them when boiled as spinach.

(3573.) *Violidæ.* The roots of the *Violidæ* are in general more or less emetic, and several have been used as substitutes for ipecacuanha; such for example as the *Ionidium poaya* and *I. parviflorum:* the *Pombalia Itubu* is commonly sold as ipecacuanha at Pernambuco, and it is there esteemed the most efficient remedy known against dysentery.

The violets are exceedingly beautiful, and often very fragrant plants, well worthy on those accounts of cultivation; but, excepting as delicate chemical tests for acids and alkalies, they are seldom applied to any economical advantage. The *Heart's-ease*, *Viola tricolor,* was once esteemed efficacious in the cure of cutaneous disorders. This plant, when bruised, smells like peach-kernels; and hence, probably, it contains prussic acid: the same odour is also communicated to water in which it has been distilled.

(3574.) Droseraceæ. The Sundew and its allies are delicate herbaceous plants, only two being in anywise suffrutricose, and often glandular. The leaves are alternate, frequently crowded at the base of the stalk, (except in *Dionæa,*) circinnate in vernation, and exstipulate or furnished with stipulary hairs. The inflorescence is terminal, the peduncle gyrate when young, often 1-flowered, or in unilateral racemes. The flowers are regular and united, and in colour blue, purple, yellow, white, or tinged with red. The bracteæ are abortive or small, seldom foliaceous.

The calyx is formed of five equal sepals, permanent and imbricate in æstivation. The petals are 5, discrete, or, as in *Romanzowia*, connate, exserted alternately with the sepals, and usually marcescent. The stamina are persistent and marcescent, like the corolla; free, and either equal in number to the petals and alternate with

them, or 2 - 3 - 4 times as many. The anthers are 2-celled, erect and dehiscent by chinks, seldom by terminal pores, as in *Byblis* and *Roridula*. The germen is sessile, formed of 3-5 connate carpels, with discrete or connate styles, cleft or branched, and many-ovuled parietal placentæ. The fruit is capsular, 1-celled, or subtrilocular, rarely 3-celled; 3-5 valved with introflexed margins, dehiscent from the apex, and bearing the seeds on median placentæ, or at their base; hence the seeds are disposed in two rows along the middle nerve of each valve, or crowded together at the bottom of the capsule; and they are either naked or covered with a thin follicular arillus. The albumen is cartilaginous or fleshy, the embryo straight, erect in the axis of the albumen, slender, with thickish cotyledons, and the radicle obtuse and turned towards the hilum.

(3575.) Hence, differentially considered, the *Droseraceæ* are circinnate *Cistianæ*, with definite stamens, styles distinct, or but slightly connate, and the embryo erect and straight.

(3576.) The *Droseraceæ* are bog-plants, mostly of a curious and elegant appearance, and remarkable for the glands and numerous hairs with which, excepting Parnassia, they all are furnished. The mechanical contrivance by which the irritable leaves of *Dionæa* are enabled to catch flies and other small animals has rendered this plant familiar to most persons; and the little *Droseræ*, though less irritable, greatly resemble it. Parnassia is likewise a very interesting plant, from the gradual development of its stamens taking place at notable epochs, of which a good account has been published by Mr. Baxter, of the Oxford Physic Garden, in his "*Flora Picta.*" *Drosera communis*, a native of Brazil, is said by M. St. Hilaire to be poisonous to sheep, and our indigenous species have also been said to be deleterious to cattle; but if so, it must rather depend upon the ova of the fluke (Hydra hydatula,) being deposited upon them than to their intrinsic properties, for they are very slightly acid, and their acridity is scarcely perceptible.

(3577.) *Aldrovanda vesiculosa* is remarkable for being provided with numerous tufts of air-bladders, by which it is buoyed up in the water in which it floats; a similar economy exists in *Utricularia*, a plant hereafter to be mentioned.

(3578.) Cistaceæ. The Rock-roses and their allies are shrubs, undershrubs, or herbaceous plants, with impunctate, simple, usually entire, sometimes toothed leaves, alternate or opposite, petiolate, and mostly furnished with free marcescent or foliaceous stipules. The inflorescence is either terminal and solitary, or in unilateral racemes (scorpioid cymes?) and the pedicles bibracteate. The leaves and branches are often covered with viscid secretions; the blossoms resemble the rose, are very fugacious, lasting only for a day, and are of various hues, such as white, yellow, red and purple, the claws being mostly of a different colour from the limbs.

The calyx is formed of 5 permanent sepals, continuous with the pedicle, and usually unequal, the 2 exterior being for the most part much smaller than the 3 interior ones, and often nearly wanting. The æstivation of the larger sepals is contorted. The petals are 5, crumpled and twisted in æstivation, but in a contrary direction to the sepals, *i. e.* to the left. The torus is obsolete. The stamens indefinite, the filaments free; the anthers innate, ovate, 2-celled, and dehiscent longitudinally by chinks. The germen is free, formed of 3-5 connate carpels, 1 or many celled, with parietal placentæ in the axes of the valves; the style is terminal, and the stigmata simple.

The fruit is capsular, 3-5, rarely 10-valved, each valve bearing a parietal placenta on its median line, which sometimes jut out, forming more or less complete dissepiments, and render the capsules more or less completely 1-or many-celled. The seeds are numerous and small, truly parietal in their placentation, but often apparently central or subcentral. The albumen is mealy, the embryo curved or spiral, in the midst of the albumen, inverted, with the radicle abhilose, but by its curvature directed towards the hilum; the cotyledons are entire and foliaceous in germination.

(3579.) Hence, the *Cistaceæ*, differentially considered, are impunctate *Cistianæ*, with a contorted æstivation, indefinite stamens, one-celled or spuriously many-celled capsules, exarillate seeds, mealy albumen, and inverted spiral or curved embryos.

(3580.) This is a small type, including only 4 known genera. They are more ornamental than useful plants; all of them innocuous, but none possessed of any very remarkable properties. The gum-resin called Ladanum is procured from several species of *Cistus*, as *C. Ladaniferus*, *Creticus*, *Ledon*, *laurifolius*, and others. Its name, Ladanum, is derived from the Arabic term *Ledon*, and formerly this substance was much esteemed as a stimulant and emmenagogue; it has also been recommended in chronic catarrh; but it is now little used, excepting as an ingredient in a warm plaster, and for fumigations. Ladanum is collected either by beating the plants with leathern thongs, or harrowing them with instruments resembling rakes, to which the thongs are attached, and to which the exudations adhere, and are subsequently scraped off. Dioscorides tells us that in his time it was collected by goats, who, when suffered to browze on the plants, brought home a considerable quantity of the gum-resin sticking to their beards, which the peasants scraped off with a kind of comb made for that purpose.

(3581.) Bixaceæ. Bixa and its typical allies are trees or shrubs, often glabrous, with alternate simple entire leaves, usually pellucido-punctate, and furnished with caducous stipules. The inflorescence is axillary, solitary, or congested, and the flowers are regular and united.

The calyx is free, 4-8 sepaled, either free or connate at the base, and imbricate in æstivation. The petals are 5, like the sepals, or sometimes wanting. The stamina are indefinite, exserted either from the receptacle or from a disk that lines the bottom of the calyx; the filaments are free, and the anthers 2-celled. The germen is superior, sessile, 1-celled, with 2-7 simple many-ovuled parietal placentæ, and a single style, either undivided or 2-4 cleft at the apex.

The fruit is capsular or baccate, 1-2 celled, and many seeded. The seeds attached to parietal placentæ, and enveloped in a fleshy membrane. The albumen is fleshy or very thin; the embryo included, nearly straight or curved; the radicle pointing towards the hilum, and the cotyledons leafy.

(3582.) Hence, selecting the chief differential characters, the *Bixaceæ* are glabrous or pellucido-punctate *Cistinæ*, with indefinite stamens, 2-7 parietal placentæ, single style, erect embryo, and seeds enveloped in pulp, or included in an arillus.

(3583.) Half the genera in this small type are destitute of petals. In habit they closely resemble the *Flacourtiaceæ*, which follow, and show even some similitude to the *Malvaceæ* of a succeeding section. In their fruit, however, they approach nearer to the Cistaceæ than to any other group. They are not remarkable either for beauty or utility. *Arnotto*, a well-known dye and pigment, is pre-

pared from the red pulpy matter that surrounds the seeds of *Bixa Orellana.* By the Spaniards this drug is used extensively to heighten the flavour and impart a rich colour to their soups and chocolates, and it is also much used both in Holland and England to give a fine red colour to cheese. The bark of this tree makes good ropes for common purposes, which are useful in the West Indian plantations; and pieces of the wood are employed by the Indians to procure fire by friction.

(3584.) *Lœtia Guidonia,* the rod-wood of Jamaica, yields a serviceable timber for building, and the bark of the *Ludiæ* is said to be possessed of emetic powers. It is caducous; and hence the plant has received the name of *Barkless wood,* the *Bois sans ecorce* of the French colonists.

(3585.) FLACOURTIACEÆ. *Flacourtia* and its typical associates are equatorial shrubs or small trees, with alternate, exstipulate, simple, penninerved leaves, shortly petiolated, often entire and coriaceous; the inflorescence is axillary, solitary or congested, and the flowers are regular and usually united, but sometimes separate by abortion. The calyx is formed of 4-7 sepals, slightly coalescent at the base. The petals equal in number to the sepals, and exserted alternately with them, very rarely absent. The stamens are equal to the petals in number, or twofold, or some multiple thereof; and occasionally changed into nectariferous scales. The filaments are free, and the anthers 2-celled. The germen is free, roundish, sessile, or shortly stalked, 1-celled, with 2-9 parietal branched placentæ, many ovules; style absent or filiform, and stigmata simple, equal in number to the valves of the ovary, and more or less distinct.

The fruit is 1-celled, and either baccate and indehiscent, or capsular, 4-5 valved, and filled with a soft pulp. The seeds are few, thick, usually invested with a pellicle formed by the withered pulp, attached irregularly to the branched placentæ, and not disposed in longitudinal series, as in the *Violaceæ* and *Passifloraceæ.* The albumen is fleshy and suboleose. The embryo straight and slender, with the radicle turned towards the hilum, and the cotyledons flat, oval, and leafy.

(3586.) Hence, selecting the chief differential characters, the *Flacourtiaceæ* are a-or apo-petalous *Cistianæ,* with exstipulate leaves, definite connate sepals, parietal branched placentæ, straight embryo, and fleshy or suboleose albumen.

(3587.) The genera here associated are distributable into two subtypes, called, from *Flacourtia* and *Erythrospermum,* the *Flacourtidæ* and *Erythrospermidæ.*

(3588.) In the *Flacourtidæ* the flowers are apetalous;

(3589.) And in the *Erythrospermidæ* the corolla is present.

(3590.) *FLACOURTIDÆ.* *Ryanœa* and *Patrisia* differ, by having united flowers, from *Flacourtia, Roumea,* and *Stigmarota,* in which, from abortion, they are separated. Two subtypical districts have hence been formed, the first of which has been called *Patrisiæ,* and the second *Flacourtiæ.*

(3591.) *Flacourtia Ramontchi* is the Madagascar plum, so called from the resemblance of its fruit to ordinary prunes. The fruit of other species, such as *F. sapida, inermis, sepiara, cataphracta,* &c. are also eatable, and the young shoots of the latter, which have an astringent bitter taste, are esteemed as a good stomachic medicine.

(3592.) *ERYTHROSPERMIDÆ.* Like the preceding subtype this is distributable into two districts, in one of which the genera with united flowers, viz. *Kiggelaria, Melicytus,* and *Hydnocarpus,* are included, while the latter, in which they

are united, contains only the genus Erythrospermum. By De Candolle the first of these groups is called *Kiggelarieæ*, and the second *Erythrospermeæ*.

(3593.) *Hydnocarpus inebrians* is the only species of note in this group; it is a poisonous plant; and its berries, when eaten, occasion giddiness, and dangerous intoxication. It is a native of Ceylon, and its fruit is greedily devoured by fish, but it is found that when thus captured their flesh is not wholesome, as it occasions vomiting and other untoward symptoms.

(3594.) Marcgraviaceæ. *Marcgravia*, *Antholoma*, *Norantea*, and *Ruyschia*, which form this type, are shrubs, with usually scandent or scrambling stems, and alternate simple, entire, exstipulate leaves. The inflorescence is umbellate or spicate, the peduncles either ebracteate, or furnished with simple or cucullate bracteæ; and the flowers are regular and united.

The sepals (2-7) are ovate, usually coriaceous, and imbricate in æstivation. The petals are sometimes free and sometimes connate, forming a calyptra, which is either entire or jagged at the apex; and the petals, when free, are circumscissile, and caducous after expansion. The stamina are either definite or indefinite, and exserted either from the receptacle or from an hypogynous membrane formed by the union of their bases (?). The filaments are dilated below, the anthers elongated, innate, and dehiscent inwards. The germen is free, superior, often furrowed, 1-celled, or subplurilocular by means of very thin dissepiments, and the ovules numerous. Style 1, variable in length, and the stigmata simple or capitate.

The fruit is a coriaceous capsule, for the most part roundish, many-valved and scarcely dehiscent, with incomplete seminiferous dissepiments springing from the middle of the valves, and meeting at the base and apex, but not produced to the axis in the centre, so that the fruit is subplurilocular, or rather unilocular, with subparietal placentæ. The seeds are indefinite, very small, and enveloped in pulp. The form and position of the embryo are as yet unknown.

(3595.) Selecting the chief differential characters, the *Marcgraviaceæ* are syn- or apo-petalous *Cistianæ*, with mostly indefinite stamens, a coriaceous many-valved capsule, subparietal placentæ, and minute indefinite seeds enveloped in pulp.

(3596.) Small as is this type it is divided into two subtypical groups or districts, the *Marcgravieæ* or *Marcgravidæ*, and *Norantea* or *Norantidæ*.

(3597.) In the first, containing *Marcgravia* and *Antholoma*, the corolla is calyptriform, and the stamina obviously exserted from the receptacle.

(3598.) While in the second, including *Norantea* and *Antholoma*, the five petals are free, and the stamens so closely pressed upon the corolla that they appear to be exserted from it.

(3599.) The *Marcgraviæ* and *Noranteæ* are very remarkable plants, handsome climbers, with curious pitcher or hood shaped bracteæ, something resembling the vessels formed by the metamorphosed leaves and leaf-stalks of *Cephalotus* and *Nepenthes*; and on the same plan as the extraordinary trap appendages of *Dionæa* and *Drosera*. Of the properties of these plants there is at present nothing known, and even their station is debateable; for the synpetalous circumscissile corollæ of the first subtype, with their innate anthers and alternate leaves, would approach them to the Ebenaceæ of the *Syringales*, while the subparietal mode of placentation, and the number and disposition of the seeds, would associate them with the *Cistinæ*, and in habit they agree with the *Clusiæ* of the present section, being

often climbing subparasitic plants, sending out roots from their nodi in search of food.

(3600.) Tamaricaceæ. The *Tamarisk*, and its allies, *Myricaria* and *Hololachna*, which form this type, are shrubs or perennial suffruticose plants, with rod-like branches, small, entire, alternate, scale-like leaves, usually glaucous, sometimes subimbricate and dotted or diaphanous at the apex, and destitute of stipules. The inflorescence is spicate or racemose, and the flowers regular and united.

The calyx is synsepalous, 4-5-parted, persistent, and imbricate in æstivation. The petals are exserted from the base of the calyx, equal in number to the sepals, alternate with them, and also imbricate in æstivation. The stamens are either equal in number to the petals or twice as many, the filaments are free or monadelphous, and the anthers 2-celled, and dehiscent longitudinally by chinks. The germen is superior, free, pyramidal and trigonal, the style short, and the stigmata three.

The fruit is capsular, 3-valved, 3-cornered, 1-celled, and many-seeded. The placentæ are 3, and situated either at the base of the ovary or along the middle of the valves. The seeds, mostly indefinite, are erect or ascending, oblong, compressed, comose at the apex, and exalbuminous. The embryo is straight and small, the radicle inferior, and the cotyledons oblong and plano-convex.

(3601.) Hence, differentially considered, the *Tamaricaceæ* are exstipulate shrubby *Cistianæ*, with definite stamens, parieto-basal placentæ, and comose exalbuminous seeds.

(3602.) The *Tamarisks*, all formerly included in a single genus, are innocuous plants, more or less bitter and astringent, but most remarkable for affording a large quantity of fixed salts, especially sulphate of soda, which may be collected by burning the leaves and branches and washing the ashes. *T. Gallica* and *Africana* are considered slightly tonic, and the root of *Myricaria Germanica* has been recommended as a useful diuretic. Ehrenberg states that it is a variety of *Tamarix Gallica*, which produces that peculiar saccharine and gummy matter known as the manna of Sinai.

(3603.) The affinities of this type are, like those of the preceding, somewhat questionable. De Candolle places it among the calycifiorous Myrtosæ, but the stamens are surely *not* perigynous, and when *Reaumuria* and *Fouquiera* were associated with *Tamarix*, they were collectively approximated to the Portulaceæ of the *Crassulinæ*, and hence to the following types, between which and their old associates an analogy exists, as indicated by their relative positions in the ascending and descending scales of these two coincident suborders. Another connexion has also been pointed out between them and the *Lythraceæ* and *Onagraceæ*, one small type of which, viz. the once aberrant *Elatinaceæ*, included among the *Salicariæ* by Bartling, has been removed from the *Onagrinæ*, and now follows the *Tamaricaceæ* as the primary group of the succeeding section.

DIANTHINÆ.

(3604.) This section is equivalent to the *Caryophylleæ* of Jussieu, now distributed into two or three types or small modern orders, which, although sufficiently distinct as types, appears still to be advisedly associated together in one common and more general group, which, as the old name *seems* to refer to the clove rather than to the clove gilly-flower, had perhaps, to avoid confusion, better be changed to *Dianthinæ*, from *Dianthus*, the carnation.

(3605.) The DIANTHINÆ, collectively considered, are a- or apopetalous hypogynous dicotyledons or *Rhœadosæ*, with shrubby or herbaceous stems, opposite, entire, exstipulate leaves, imbricate sepals and petals, undivided germen, central placentæ, seeds numerous, rarely exalbuminous, albumen when present mealy, and the embryo mostly curved.

C

Lychnis grandiflora.

c. Entire plant.

(*a*) Flower before expansion, to shew the æstivation of the sepals and the petals.

(*b*) A petal with its stamen.

(*c*) Flower deprived of calyx and corolla, to shew the germen, styles, and stamens.

(*d*) Fruit, included in the persistent calyx.

(*e*) Capsule divested of the calyx.

(*f*) Transverse section, to shew the central placenta and many seeds.

(*g*) A seed detached.

(*h*) Section of ditto, to shew the curved embryo coiled round the albumen.

(3606.) Two types are included in this suborder, which, from *Elatine* and *Dianthus*, are called the *Elatinaceæ* and *Dianthaceæ;* the latter is again divisible into two subtypes, so that sometimes three distinct types are enumerated.

(3607.) ELATINACEÆ. *Bergia*, *Elatine*, and *Merimia*, which together form this type, are annual herbaceous plants, with rooting fistulous stems and opposite exstipulate leaves. The inflorescence is axillary, solitary or crowded, and the flowers are regular and united.

The sepals (3-5) are discrete or slightly connate at the base, the petals hypogynous, alternate with the sepals, and equal to them in number. The stamina usually twice as many as the petals; the germen superior and free, formed of 3-5 connate carpels, 3-5-celled, with central multiovulate placentæ, and the styles as many as the cells of the ovary, and the stigmata capitate.

The fruit is a 3-5-celled capsule, the valves being alternate with the septa, and the edges introflexed: the dissepiments usually adhere to the central axis, but in Merimia they adhere to the valves and separate from the axis. The placentæ are truly central, and often form an axial column. The seeds are numerous and exalbuminous; the embryo straight, and the radicle turned towards the hilum.

(3608.) Hence, differentially considered, the *Elatinaceæ* are exalbuminous *Dianthinæ*, with introflexed capsular valves and capitate stigmata.

(3609.) The *Elatinaceæ* are homely weeds with insignificant flowers, abounding in marshes and waste places: as far as at present known they are innocuous,

but not possessed of any important economical or medicinal properties. Besides their general affinity to the Cistinæ, they agree with the Hypericaceæ in having receptacles for resinous secretions.

(3610.) Dianthaceæ or (*Caryophylleæ*). *Dianthus*, and its typical associates, are herbaceous or suffruticose plants, with tumid nodi, and often fistulous internodia, opposite entire leaves, frequently connate at the base, and destitute of stipulæ. The inflorescence is terminal, either solitary or cymose, and the flowers are united, and for the most part symmetrical.

The sepals (4-5) are continuous with the pedicle, in one subtype free, in the other distinct; persistent and imbricate in æstivation. The petals (sometimes absent) are equal in number to the sepals, alternate with them, unguiculate and exserted from an elevated torus or pedicle of the ovarium, and mostly with nectareous scales in the faux. The stamens are twice as many as the petals, and exserted with them from the stipitiform torus. The filaments are subulate, sometimes free and sometimes monadelphous; and the anthers innate, 2-celled, and dehiscent longitudinally by chinks. The germen is free and stipitate, simple, ovate or oblong, 2-5-valved, 1 or more celled and many-ovuled, and crowned by 2-5 stigmatic styles, filiform or clavate, discrete from the apex of the germen, and papillose internally.

The fruit is capsular, 2-5-valved, with the valves united at the base, and dehiscent longitudinally at the apex; 1-celled with free central placentæ, or 2-5-celled or submultilocular, the dissepiments proceeding from the valves more or less completely to the axis. The seeds are numerous, indefinite, rarely definite, and arranged in double rows along the central trophosperms. The albumen is mealy, and the embryo curved round it with the radicle pointing towards the hilum.

(3611.) Hence, differentially considered, the *Dianthaceæ* are albuminous *Dianthinæ*, with central placentæ, a curved embryo, and filiform stigmata.

(3612.) The genera here associated are distributable into two subtypes, which, from *Silene* and *Alsine*, are called the *Silenidæ* and *Alsinidæ*.

(3613.) In the *Silenidæ* the sepals are connate, forming a cylindrical tube, the torus is columnar and distinct from the calyx, and the germen is 1- or more celled.

(3614.) While in the *Alsinidæ* the sepals are distinct or very slightly connate, not tubular, the torus not columnar, and adherent to the calyx, and the germen 1-celled.

(3615.) This is a group of wholly innocuous plants, in general both insipid and inodorous, and possessed of no remarkable properties. Some few, as the clove-gillyflower, are fragrant and aromatic, and are used in the manufacture of a grateful syrup. Others, such as the chick-weed, are nutritious plants, and the favorite food of small animals. The spurry is said to form an excellent fodder for cows; in some places it is sown late in the season on poor lands for the sake of supplying kine with green meat, as it is said to enrich the milk and increase the quantity of butter. Von Thaers affirms that the Spergula arvensis is the most nourishing for its bulk of all fodder. Hens eat it greedily, and it is supposed to favor their laying a greater number of eggs than they do under ordinary circumstances.

Saponaria Vaccaria is the cow-herb, so much esteemed by Continental dairymen for increasing the lacteal secretion in their beasts. The *Saponaria officinalis*, *Gypsophila Struthium*, and some species of *Lychnis*, have long been noted for

their soapy properties, and are occasionally used in washing. *Arenaria peploides*, which grows on the sea shores in most parts of Europe, although neglected in temperate latitudes, becomes esteemed as an esculent vegetable in more northern regions. In Iceland it is collected with care, and when fermented affords a wholesome and nutritious food. The young shoots of Silene inflata form a very delicate vegetable, which might be substituted for green-peas or asparagus, as they have something the taste of both: it is therefore a plant well deserving cultivation.

The root of *Silene Virginica* is said to be possessed of anthelmintic powers, and is used in North America as a vermifuge.

(3616.) Most of the *Dianthaceæ* are pretty but humble weeds, and some have very homely inconspicuous blossoms; but, on the other hand, there are several that are splendid, such as the *Dianthi*, the very name of which asserts them to be flowers fit for Jupiter; and some of the *Lychnides* are scarcely to be surpassed in beauty.

The numerous sorts of carnations and clove-pinks, known to florists as *Picotees, Bizarres*, and *Flakes*, are all of them varieties of *Dianthus Caryophyllus;* and the sweetwilliams, sweetjohns, Deptford, and other pinks, are well-established favorites, which maintain their rank in almost every garden, notwithstanding the continued immigration of more shewy foreigners.

GRUINÆ OR GERANINÆ.

(3617.) Much difference of opinion exists as to the affinity of the types included in this section. For some systematists, as Auguste de St. Hilaire and Richard, esteem their connexion to be so intimate as not even to justify their typical separation, while others, as De Candolle and Bartling, not only divide them into several orders, but station these groups at a distance from each other. An intermediate course appears to be the most advisable; for, although sufficient differences exist to warrant their special segregation, their general similitude is so great as to demand their association in one common section.

(3618.) Collectively considered, the Gruinæ are herbaceous or suffruticose *Rhœadosæ*, with impunctate leaves, imbricate sepals, imbricate or contorted petals, definite stamens, aggregate or connate carpels, axial placentæ, and definite seeds.

(3619.) The types included in this section are five in number, and, from their normal genera, *Linum, Oxalis, Balsamina, Tropæolum*, and *Geranium*, they have been called the *Linaceæ, Oxalidaceæ, Balsaminaceæ, Tropæolaceæ*, and *Geraniaceæ*. The common collective name is a modification of the Linnean term *Gruinales*, which order contained many of the plants referred to in the present section.

(3620.) Linaceæ. The Flax, and its typical associate *Radiola*, are herbaceous or suffruticose plants, with simple entire leaves, usually alternate and exstipulate, but sometimes with basal glands. The inflorescence is terminal, in racemose corymbs or panicles; the flowers are regular and united, either blue, white, or yellow, and very fugacious.

The calyx consists of 5 (rarely 3-4) sepals, slightly connate at the base, continuous with the peduncle, imbricate in æstivation, and persistent. The petals, equal in number to the sepals, are alternate with them, unguiculate, and con-

torted in æstivation. The stamens are equal to the petals in number, and alternate with them, slightly monadelphous, with a tooth or abortive filament between each, and hence opposite the petals. The anthers are ovate and innate, 2 celled,

A. *Oxalis violacea.* (*a*) Stamens and pistils, the calyx and corolla being removed. (*b*) One of the sepals. (*c*) The pistil. (*d*) One of the 5 carpels cut lengthwise, to shew the pendent ovules. (*e*) The entire fruit. (*f*) Transverse section. (*g*) A seed. (*h*) Longitudinal section, to shew the embryo.

B. *Linum trigynum.* (*a*) Calyx, stamens, and pistils, the corolla being removed. (*b*) The germen, styles, and stigmata. (*c*) The fruit. (*d*) Transverse section of ditto. (*e*) A seed. (*g*) Transverse section of ditto. (*f*) The embryo.

C. *Geranium pratense.* (*a*) A flower, the corolla having been removed to shew the sepals, stamina, and pistil. (*b*) The pistil. (*c*) The fruit. (*d*) The fruit with the carpels separating at the base by the elastic styles from the indurated axis.
(*e*) A seed. (*f*) The embryo. (*g*) Transverse section of the same.

and dehiscent longitudinally by chinks. The germen is subglobose, with as many cells as there are sepals (rarely fewer). The styles 5-3, equal in number to the cells, distinct and filiform, and the stigmata capitate.

The capsule is subglobose, usually acuminate and crowned with the persistent bases of the styles, 5- (rarely 3) celled, each carpel having its edges induplicate, and bearing on its median line an incomplete dissepiment, so that each cell is imperfectly divided into two, each of which compartments contains a single seed. The seeds are ovate, compressed, inverted, and shining. The albumen absent or very spare, its place being supplied by the tumid endopleure. The embryo is straight, flat, fleshy, and oily; the radicle turned towards the hilum, and the cotyledons elliptical.

(3621.) Hence, differentially considered, the Linaceæ are exstipulate *Geraninæ*, with symmetrical flowers, submonadelphous stamens, connate carpels, capitate stigmata, subsolitary pendulous seeds, and little or no albumen.

(3622.) These are innocuous plants, remarkable for the beauty of their flowers, but still more celebrated for the value of the fibre, which, when duly prepared, forms the flax of commerce, whence linen is made. Several species of Linum afford a tenacious fibre, but none so valuable as that of the *L. usitatissimum*, so called from its extreme utility, and the various economical purposes to which its several parts are applied. The fibre of its stem when macerated affords flax; its seeds are oleaginous, and from them linseed oil is expressed; and the mark, which is left after the expression, is the oil-cake upon which oxen are fattened. The seeds also contain a large quantity of bland mucilage, whence their use in decoction as demulcents; and linseed meal forms one of the best materials for cataplasms.

(3623.) The flax used in this country is chiefly of foreign growth, for, notwithstanding the rewards held out by the legislature to encourage its domestic culture, it is found in well-peopled districts to be an unprofitable investment, not only from its inferior value to corn, but from its being one of the most exhausting crops that can be grown, especially when allowed to ripen its seeds. Our principal supplies are drawn from Russia, the Netherlands, and Prussia; some is also brought from France, Egypt, and even from New South Wales. The annual imports vary from 40 to 50,000 tons of flax and tow, now subject to the reduced duty of one penny per cwt.; and about two million bushels of linseed. The process of dressing flax is considered unwholesome, and the maceration necessary to separate the fibres renders water so very offensive, that, in the reigns of Henry VIII. and our first James, acts were passed to prevent this process being carried on in any stream or pond where cattle drank, under a heavy penalty. The new plan of steeping flax in hot water with soft soap is said to be a great improvement, and it was for this process that a secret or unenrolled patent was granted about twenty years ago to Lee, its inventor.

Even the common flax is said to be slightly aperient, but several other species certainly are so, and have been used medicinally as cathartics, such as *L. catharticum* and *L. selaginoides*; *L. aquilinum* is esteemed in Chili as a stomachic as well as an aperient.

(3624.) Oxalidaceæ. The wood-sorrel (*Oxalis*), and its typical allies, are herbaceous or suffruticose (rarely arborescent) plants, with alternate, mostly exstipulate, compound leaves, sometimes simple by abortion, and occasionally but very seldom opposite or nearly whorled. The inflorescence is axillary, sertulate, or racemo-paniculate, seldom solitary, and the flowers are regular and united.

The calyx consists of 5 sepals, free or slightly coherent at the base, equal, persistent, and imbricate in æstivation. The petals are 5 in number, deciduous, equal, with erect ungues, sometimes slightly connate by their bases, and spirally contorted in æstivation. The stamens are definite (10), with erect subulate filaments often monadelphous at the base; those which are opposite the petals form an inner series, longer than those which are in the normal position. The anthers are 2-celled and innate. The germen is free, 5-angled and 5-celled, formed of 5 connate carpels opposed to the sepals, the styles 5 and distinct, filiform and variable in length, and the stigmata penicilliform, capitate, or subbifid.

The fruit is capsular, rarely baccate, 5-cornered, 5-celled, 5-10-valved, and

dehiscent longitudinally at the angles. The seeds are few, attached to the axis or placentæ in the angles of the cells, striated, when young enclosed within a fleshy integument, often called an arillus, which at maturity bursts elastically and expels the seeds. The albumen is subcartilaginous. The embryo inverted, the length of the albumen, the radicle long and superior, and the cotyledons foliaceous. [§ 3620, A.]

(3625.) Hence, differentially considered, the *Oxalidaceæ* are *Geraninæ* with compound leaves, symmetrical flowers, free or submonadelphous stamens, 5 connate carpels, and arillate albuminous seeds.

(3626.) The immediate affinities of these plants are questionable; for, although without doubt related to the *Geraniaceæ*, from which by many persons they are not even considered as typically distinct, others, as De Candolle, believe them to be more nearly related to the *Zygophyllidæ* of the *Rutaceæ*, to which their compound leaves as well as other characters approach them.

(3627.) The *Averrhoæ* differ from the rest of the *Oxalidaceæ* in their arborescent port. *A. Bilimbi* is the cucumber-tree of *Goa*, and is cultivated on the banks of the Ganges, and in many other parts of the East Indies, for the sake of its fruit, which resembles a small cucumber, and has a grateful acid flavour. A syrup is made of the juice, and a conserve of the flowers, which are esteemed as excellent cooling medicines in fevers.

(3628.) *A. Carambola* is the *Camrungo* or *Carambola* of Hindustan. Its fruit is eatable, but not so palatable as that of the *Bilimbi*. The leaves of this tree are sensitive, and Bruce gives a curious account of their motions, and of the movements of the leaf-stalks; and even, according to his report of the branches, *Oxalis* (or *Biophytum*) *sensitiva*, is also irritable, and the leaves collapse when touched.

(3629.) The *Oxalides* are acid and slightly astringent plants, especially *O. Acetosella*, which contains that peculiar and powerful acid, the Oxalic, to which it has given its name. This plant was formerly used in medicine, being made into a confection called *Conserva Luzûlæ*. Twenty pounds of wood-sorrel leaves yield six pounds of juice, from which two ounces six drachms of impure salt may be obtained. Since however Scheele discovered that oxalic acid may be formed by acting on sugar with nitric acid, his process, being far the most economical, has entirely superseded its extraction from the plant. *Oxalic acid* mixed with cream of tartar is sold under the name of salt of lemons, to flavour sauces, and to remove ink-spots and iron-moulds.

(3630.) Several species of oxalis have granulate or tuberculate roots; and those of the *O. crenata* are used as a dietetic vegetable in Columbia. It has lately been introduced into this country, where it grows freely; its tubers are fleshy and have a pleasant flavour, and by some persons are preferred to those of the potato.

The roots of *O. tuberosa* and *violacea* are also esculent, and the leaves of *O. tetraphylla* are eaten in Mexico.

(3631.) BALSAMINACEÆ. The *Balsams* and their typical allies are tender, succulent, herbaceous plants, with simple leaves, alternate or opposite, and destitute of stipules. The inflorescence is axillary, solitary, or crowded, and the flowers irregular and united; and in their colour white, yellow, or red. The calyx is irregular and deciduous, formed of five sepals, the two inner and upper of which are connate, and the lower spurred. The corolla consists of four petals united in pairs, so that apparently two only are present; and the fifth is in reality

abortive. The stamens are five, and closely surround the ovary; the filaments are subulate, the anthers are coherent, those of the two superior stamens 1-celled those of the three inferior ones 2-celled, and dehiscent longitudinally by chinks. The germen is formed of five connate carpels, 5-celled and many-ovuled, the styles are absent, and the stigmata distinct or connate. The fruit is capsular, 5-valved, and sub-5-celled; the placenta is central, and adherent to the apex of the ovary by five slender threads, (as in Dianthaceæ,) 5-angled, and with membranous projections that form the dissepiments; hence the fruit is 5-celled at the base, but 1-celled above the placenta. The seeds are numerous and pendulous, ovate-oblong and exalbuminous; the embryo is straight, the radicle superior, and the cotyledons plano-convex.

(3632.) Hence, differentially considered, the *Balsaminaceæ* are herbaceous *Geraninæ*, with simple exstipulate leaves, unsymmetrical flowers, a spurred calyx, imperfectly 5-celled ovary, and indefinite exalbuminous seeds.

(3633.) These plants have very complex affinities; for, as De Candolle remarks, they have the flowers of the *Fumariaceæ*, the capsules of the *Oxalidaceæ*, the seeds of the *Linaceæ*, and a habit peculiarly their own. But when De Candolle wrote, the structure of the flowers was misunderstood; and it is to Kunth that we owe its just explication. The nearest connexions of the type seem to be with the *Oxalidaceæ* on the one hand, and the *Tropæolaceæ* and *Geraniaceæ* on the other.

(3634.) The Balsams are for the most part innocuous plants, and not possessed of any very active properties, but much esteemed for the beauty of their flowers and their elegance of port. The elastic dehiscence of their capsule is also a remarkable circumstance; and an allied genus has been named, from the force with which it scatters its seeds immediately when the capsules are touched, *Impatiens noli me tangere*, or *Touch me not*.

(3635.) The leaves of *Impatiens noli me tangere* are said to be acrid, and refused as food by all animals except goats. Boerhaave even regarded the plant as poisonous; and, although it was once used as a diuretic, it was in general considered a dangerous medicine.

(3636.) The juice of the garden-balsam, *B. hortensis*, is employed by the Japanese when mixed with alum to dye their nails red; and the leaves of *B. cornuta* are boiled to make a wash, which the Cochin-Chinese employ to cleanse and perfume the hair.

(3637.) Hydrocereæ. A single species, a native of Java, forms the genus *Hydrocera*, which, although intimately connected with the *Balsaminaceæ* and *Tropæolaceæ*, especially with the former, differs from both in having a drupaceous fruit. Hence Blume, by whom it was discovered, has made it the type of a new family, which he calls *Hydrocereæ;* but whether this should be considered an independent group, or only a subtype of the *Balsaminaceæ*, is as yet undecided; it may therefore for the present stand as the connecting link between the two types to which it bears the greatest resemblance.

(3638.) The *Hydrocereæ*, differentially considered, are exstipulate *Geraninæ*, with a calcarate calyx, definite stamens, slightly connate anthers, concrete ovarium of several cells, with central placentæ, drupaceous fruit, and solitary exalbuminous seeds.

(3639.) Tropæolaceæ. *Tropæolum* and *Magallana*, which together form this

type, are smooth and tender herbaceous plants, with diffuse or twining stems, alternate, petiolate, peltate leaves, destitute of stipulæ. The inflorescence is axillary and solitary, and the flowers irregular and united. The calyx is free, 5-sepaled, distinct or connate at the base, coloured, the upper sepal furnished with a long distinct spur, and quincuncial in æstivation. The petals are five, exserted from the calyx, alternate with its lobes, unequal and irregular, the two upper ones sessile and remote, springing from the mouth of the spur; the three lower ones unguiculate, smaller, and sometimes abortive. The stamina are definite (8,) uniseriate, and exserted from a subhypogynous disk; the filaments free, and the anthers innate, oblong, erect, and 2-celled, dehiscing longitudinally by chinks; the germen is free and trigonal, being formed of three carpels, connate to a central column or base of the style. The cells are 1-ovuled, the styles three, connate and furrowed, and the stigmata distinct and acute. The fruit is formed of three connate carpels, (which in Magallana are reduced by abortion to one that is winged,) adnate to the base of the style or axis of the fruit; and each carpel is 1-celled and 1-seeded. The seeds are large and exalbuminous, filling the entire cavity of the carpel, and assuming its form. The embryo is large, the two cotyledons thick and straight; when young distinct, but when old conferruminate, and also adherent to the spermoderm, and the radicle lying within a process of the cotyledons, bearing four tubercles, which subsequently become rootlets.

(3640.) Hence, differentially considered, the *Tropæolaceæ* are exalbuminous *Geraninæ* with simple exstipulate leaves, irregular calcarate flowers; definite distinct stamens; capsular, indehiscent fruit; and solitary, pendulous ovules.

(3641.) The *Tropæolum*, or Trophy-cress, has been so called from the resemblance its flowers are supposed to have to empty helmets, and its leaves to shields or bucklers. Its common name, Nasturtium, refers to the similitude it bears in smell, taste, and general properties, to the *Nasturtia,* or land and water cresses; a similitude so great that the same insects, *e. g.* the cabbage-butterflies, resort to and feed on both; a curious circumstance, as the plants belong to different natural families. The leaves of *T. majus,* the Indian cress or Nasturtium, are often eaten as salad; and its seeds, as well as those of *T. minus,* are sometimes pickled as a substitute for capers. The roots of *T. tuberosum* are eatable when boiled, and are used as a culinary vegetable in Peru. *T. pentaphyllum* is esteemed as an antiscorbutic in Brazil, and most of the other species possess similar properties. *T. aduncum* is remarkable for the resemblance its irregular flowers bear to a bird; and hence, in Gibraltar and Spain, it is known as the Canary-bird flower.

(3642.) Geraniaceæ. The Crane's-bill (*Geranium*), the Stork's-bill (*Pelargonium*), and the Heron's-bill (*Erodium*), with their typical allies, *Ryncotheca*, *Monsonia*, *Sarcocaulon,* and *Grielum,* are herbs or undershrubs, with sometimes tuberous roots, and nodoso-articulated stems; the joints, when young, being separable, as in the *Viteaceæ.* The leaves are mostly simple, the lower ones opposite, the upper alternate, their fellows being supplanted by peduncles, as in the vines, but these never become cirrhose. The inflorescence is axillary or opposite the leaves, sertulate or binate, rarely solitary, and the flowers are regular or irregular, and united.

The calyx is free, persistent, formed of five sepals, more or less unequal, one being sometimes drawn out at the base into a hollow spur, which is connate with

the peduncle. The calyx is imbricate, the corolla contorted in æstivation. The petals are 5, rarely 4, or by abortion unguiculate, alternate with the sepals, equal or unequal, in the first case hypogynous, in the second often exserted from the calyx or connected to it. The stamina are definite, uniseriate, equal in number to the petals, seldom twice or thrice as many, (as in Monsonia,) some being occasionally abortive. The filaments are in general monadelphous, rarely free, and the anthers versatile, exappendiculate, 2-celled, and dehiscent lengthwise. The germen apparently 5-celled, but truly consisting of five carpels arranged round an elevated axis, each being 1-celled and 2-ovuled, the ovules pendulous, and the styles five, coherent to the lengthened axis.

The fruit is formed of 5 membranous carpels, set round an indurated lengthened axis, to which the persistent styles adhere, and during dissemination the carpels are separated by the elastic torsion of the styles. Each carpel is 1-celled and 1-seeded, the seeds pendulous and exalbuminous; the embryo curved, the radicle deflexed and pointed to the base of the cell, and the cotyledons foliaceous, convolute or flexuosely plicate, and sometimes lobed. [§ 3620, c.]

(3643.) Hence, differentially considered, the *Geraniaceæ* are exarillate exalbuminous *Geraninæ*, with 5 distinct carpels adherent to a lengthened woody axis, each being 2-ovuled and but 1-seeded; the embryo curved, and the foliaceous cotyledons convolute or plaited.

(3644.) The separable nodes of these plants associate them with the vines; the disposition of their carpels round a distinct axis, with many of the Rutinæ; and their monadelphous stamens, as well as general habit, with the Malvaceæ. *Rhyncotheca* differs from the other genera, in having albuminous seeds, and being destitute of petals.

(3645.) The *Geraniaceæ* are innocuous plants; they are in general slightly acid, and sometimes also astringent: hence a few, as *G. maculatum, Robertianum,* and *sanguineum,* have been used as astringents and vulneraries. They are also more or less fragrant, secreting resins and essential oils. In some these secretions are so abundant, that, as in *Sarcocaulon L'Heretièri,* the stems burn like torches, and yield a most agreeable perfume during their combustion. The roots of *G. maculatum* are used, when boiled in milk, as a remedy for the diarrhœa of children; and at Philadelphia it is in great repute. Barton says it might even form a substitute for kino. *Erodium cicutarium* and *moschatum* are also sometimes employed as aromatic bitters, and *P. cucullatum* as an emollient: from *Pelargonium odoratissimum* a fragrant essential oil has been distilled, said to resemble the attar of rose, or at least to be as agreeable as it; and the underground tubercles of *P. hirtum* (*crassifolium?*) are esculent, and are prized as food by the Arabs; but, notwithstanding their several domestic uses, the *Geraniaceæ* are chiefly esteemed for the beauty of their flowers, and they are deservedly great favorites, and some of the most frequent and admired denizens of our greenhouses and gardens.

MALVINÆ.

(3646.) The five natural families or groups of genera included in this section are distributable into two subsections, which, as they differ considerably in structure, should perhaps be esteemed as sectionally distinct. These are the mallows, the

chocolate, the linden, and the camphor-trees, forming the *Malvianæ* or true *Malvinæ;* and the tea, with its associates, forming the subsection Camellianæ, which is almost as nearly related to the *Hypericianæ* as to the mallows.

A. *Althæa officinalis.* Cutting, to shew leaves, flowers, and fruit. (*a*) Carpels, style, and stigmata. (*b*) Ditto, surrounded by the monadelphous stamens. (*c*) The calyx separate.

B. *Tilia alba.* (*a*) A flower separated. (*b*) One scale with its stamina. (*c*) Transverse section of the ovary. (*d*) Longitudinal section of ditto. (*e*) Fruit. (*f*) Section of ditto. (*g*) Convex side of a seed. (*h*) Internal surface of ditto.

C. *Thea Bohea.* (*a*) Calyx and pistil. (*b*) Transverse section of the ovary. (*c*) Fruit. (*d*) One carpel separated. (*e*) Ditto, with part of the pericarp removed. (*f*) Seed. (*g*) Ditto, with the two cotyledons separated.

(3647.) Collectively considered, the *Malvinæ* are hypogynous *Rosales,* or *Rhœadosæ,* with alternate simple leaves, in the one subsection imbricate sepals and petals, in the other valvate sepals and contorted petals, stamens often monadelphous and numerous, the carpels several, and either with central placentæ or disposed round a central axis.

(3648.) Differentially considered, the *Malvianæ* are mucilaginous *Rhœadosæ,* with valvate sepals and contorted petals; definite or indefinite stamens; carpels several, free or connate, arranged round a central axis, and alternate, simple, stipulate leaves;

(3649.) While the *Camellianæ,* as contrasted with the preceding subsection, are *Rhœadosæ,* with imbricate sepals and petals, indefinite stamens, connate carpels, central placentæ, and alternate, simple, exstipulate leaves.

MALVIANÆ.

(3650.) Malvaceæ. Recombining the mallow and the cotton tribes, which cannot be considered as more than subtypically distinct, the *Malvaceæ* are herbs, shrubs, or trees, with alternate simple leaves, petiolate, often palmati-nerved, furnished with free stipules, and for the most part covered with stellate down. The inflorescence is axillary, solitary, or aggregate, and the flowers regular and united.

The calyx is in general calyculate, with larger or smaller bracteæ; the sepals 5 (seldom fewer), more or less free or connate, and valvate in æstivation. The torus is dilated, free from the calyx and ovary, bearing both the petals and stamens. The petals are equal in number to the sepals, and exserted alternately with them, equal, unguiculate, often adhering with the tube of the stamens, and contorted in æstivation; occasionally, but seldom, abortive. The stamens are indefinite, rarely definite, the filaments monadelphous, and the anthers 1-celled, reniform, and dehiscent transversely, and the pollen globose and hispid. The germen is formed of several carpels, set round the axis of the flower, more or less connate or distinct, and 1- or many-ovuled. The styles are equal in number to the carpels, distinct or united, and the stigmata are variable.

The fruit is formed of several baccate or capsular carpels, either separate, separable, or strictly connate, and the cells 1-2-seeded. The seeds are attached to central or angular placentæ, often covered with down or hairs, or pulp. The albumen none, or very little. The embryo straight, the radicle round and turned towards the hilum, and the cotyledons contortuplicate.

(3651.) Hence, differentially considered, the Malvaceæ are *Malvianæ*, with a persistent calyx, monadelphous stamens, 1-celled anthers bursting transversely, exalbuminous or subalbuminous seeds, and stellate down.

(3652.) The *Malvaceæ* are all innocuous plants abounding with bland mucilaginous juices, and hence they afford emollient medicines and nutritious food.

(3653.) The *Malvaceæ* have been divided into two small orders, here considered, on account of their strict resemblances, merely as subtypes, and called, from *Malva*, the mallow, and *Bombax*, the silky cotton, *Malvidæ*, and *Bombacidæ*.

(3654.) In the *Malvidæ* the sepals are exactly valvate in æstivation, and the staminiferous tube uncleft;

(3655.) While in the *Bombacidæ* the sepals are subvalvate, and the tube of the stamens 5-cleft.

(3656.) Malvidæ. The genera here associated are referable to two subordinate groups or districts, in one of which, the *Malveæ*, the calyx is calyculate, and in the other, the *Sideæ*, it is without an involucre.

(3657.) *Malveæ*. The mallows, holly-hocks, and other genera associated in this district, are shewy ornamental plants. *Alcea*, the holly-hock, has been so called from αλκη, a remedy, as it, or some plant with similar properties, was formerly much esteemed in medicine. *Althæa*, the marsh-mallow, from αλθω, to cure, would seem also to have been held in much repute, if any reliance is to be placed on names. *A. officinalis* is the *gui-mauve, i. e.* the bird-lime or clammy mallow, of the French, and on the Continent it is much used in pectoral complaints. The pâte de gui-mauve is a very agreeable demulcent.

The leaves of *Althæa rosea* are said to yield a blue colouring matter not inferior to indigo.

(3658.) Several species of *Hibiscus* have been employed both in medicine and domestic economy. The stems of almost the whole consist of strong and tough fibres, so that they have been manufactured into ropes and whips, such especially as *H. cannabinus, arboreus, clypeatus,* and *mutabilis.* The leaves of the two former are also eatable, and those of *H. esculentus,* as well as its fruit, are esteemed as food in the Levant. The seeds when unripe form a favorite ingredient in soups, and are eaten as haricots; they, however, require much spice to enable the stomach to digest the very viscid ragouts they form. The petals of *H. Rosa sinensis* are astringent, and are employed by the Chinese to make a black dye for their hair and eyebrows, and a blacking for their shoes. The aromatic seeds of *H. Abelmoschus* have been much lauded as stomachics; and they are added as a cordial, by the Arabians, to their coffee. *Kabb-el-Misk,* its Arabic name, of which *Abelmoschus* is a vile corruption, refers to the musk-like odour of the seeds, which are often substituted as a perfume for animal musk; several other allied species, as *Malva moschata,* are also remarkable for a similar odour, which likewise occurs in *Erodium moschatum.* The mucilage procured from the root of *H. manihot* is used in Japan as size, and to give a proper consistence to paper.

(3659.) *Paritium* (olim Hibiscus) *tiliaceum,* is the *Pariti* of Malabar; its bark is textile; and in Tahiti it is made into cords, and woven into mats and cloths. Forster states that in New Caledonia, when the bread-fruit fails, the inhabitants subsist upon the bark of this tree, which, however, affords an insipid and but slightly nutritious food.

(3660.) *Gossypium,* the cotton-bearer, is a most important plant. Several species afford the valuable substance known as *cotton,* this word being an alteration of the Arabic *qothn,* as the Latin generic term is of its synonyme *qoz;* and in Egypt it is called *Gotsnenseigar.* The cotton of commerce is the downy investiture of the seeds, with which the pods are filled. *Gossypium herbaceum* is the common cotton plant of the Old World, and *G. Barbadense* of the New. Other species, as *G. hirsutum,* are however cultivated, but they are less valued, on account of the greater difficulty of separating the down from the seeds, which is at best a tedious manual operation. The seeds, when divested of their cotton, are bruised for oil, or eaten, they are said to be wholesome and nutritious. *G. religiosum* is supposed to yield the coloured cotton of which nankeen cloth is made. It appears, from the parliamentary returns, that the anual imports of cotton into this country are about 227,000,000 lbs. In 1828 there were 227,760,000 lbs. imported. Of this quantity 151,752,000 lbs. were from the United States, 29,143,000 lbs. from Brazil, 32,187,000 lbs. from the East Indies, 6,454,000 lbs. from Egypt, 5,893,000 lbs. from the British West Indies, 726,000 lbs. from Columbia, and 471,000 lbs. from Egypt and Continental Greece. These returns give some idea of the immense value of this plant, in the manufacture of whose seed-down there is invested a capital, in Great Britain alone, of £56,000,000. giving direct employment to upwards of 830,000 of our population, and being manufactured into goods of the annual value of £36,000,000.

(3661.) *Urena lobata* is aromatic and carminative, and is used in Brazil to relieve flatulence: and *Pavonia diuretica* is commended in the same country for its diuretic powers.

(3662.) *Sideæ.* Some species of *Sida* are bitter as well as mucilaginous. *S. lanceolata* is intensely so, and is esteemed a powerful tonic. The leaves of *S. carpinifolia* are used as emollient poultices to the stings of venomous insects: they are commonly chewed to a pulpy state, and applied without further preparation. Its bark, like that of the other Malvaceæ, is fibrous, and the fibres tough and tenacious, so that it makes excellent cordage. The wood of *S. micrantha* is light, and the stems so straight that it is preferred to most others for rocket-sticks.

(3663.) *Abutilon esculentum* is the *Bençaa de Deos* of Brazil, and the flowers, when cooked, are eaten in Rio Janeiro as potherbs.

(3664.) *A. exstipulare* is remarkable for deviating from the normal character of the type by its destitution of stipules. And *Euryanthe*, an intermediate genus between the *Geraniaceæ* and the *Malvaceæ*, is still more noticeable for its 2-celled anthers, which should exclude it from this group, although in other particulars it is a malvaceous plant.

(3665.) *Bombacidæ.* As there is little structural difference between this subtype and the preceding, there is also but little difference in the properties of the individual plants it comprehends. They are however more generally arborescent, and none of them are herbaceous. Some afford examples of the largest vegetables known, such as the *Baobab* of Senegal, described by Adanson, and called after him *Adansonia.* The trunks of some trees of *A. digitata*, measured on the banks of the Senegal, were found to be of the enormous girth of 90 to 100 feet. The spread of the branches and extent of the roots is also prodigious; one main root, partly uncovered by the course of the stream, exceeded 110 feet in length, that being the distance to which it was unearthed: how much farther it extended beneath the soil is unknown.

The height of these trees is not proportionable to their excessive bulk, being often little more than the diameter of the trunk, viz. 25-30 feet. The age of some of the largest has been computed at from 5 to 6,000 years; such computations are, however, very obnoxious to errors; still they may be, as Humboldt has denominated them, among the "oldest organic monuments of our planet." In the interior parts of the country, at a distance from the rivers, the trunks of these trees are converted into tanks, the heads being cut off, and the immense bodies hollowed out, for the reception of water, a task which is the more easily effected from the wood being soft and light. In Abyssinia the wild bees either perforate it to form themselves hives, or lodge in holes otherwise made; and honey which is collected from these apiaries in considerable quantities is esteemed the best produced in the country. On the eastern coast of Africa this tree is very liable to be attacked by fungi, which prey upon its heart-wood, and, without changing its colour or general appearance, destroy the life of the plant, and render its timber very soft. Trees thus destroyed are hollowed out as mausolea, or burial-places, to receive the bodies of physicians and magicians, and such other persons who, from their skill, are presumed by the superstitious natives to hold communion with evil spirits, and are therefore denied the common rites of sepulture. The bodies suspended in these chambers become dry, and are well preserved, like mummies, and are called, in the language of the country, *guiriots.*

(3666.) The bark of the Baobab yields a coarse thread, of which ropes and cloths are made; the larger leaves are used in Senegal instead of tiles to cover the

huts, and the smaller ones are eaten, not only in times of scarcity, but, when dried and powdered, they form the favorite food of the natives of the eastern coast of Africa, who call the preparation *Alo,* and mix it with their daily food. They consider it beneficial in restraining the excessive perspiration occasioned by the heat of the climate, and Europeans are said to have found it serviceable in cases of fever, and in relieving diarrhœa.

(3667.) The fruit of the Baobab, which is called Monkey's bread, is also eatable. The pulp, which invests the seeds, is sweet and farinaceous, and has something the flavour of the Carob bean, or of gingerbread, and the Africans make a kind of porridge or gruel of it, mixed with water, that they call *rooy.* This porridge, Major Pedley says, formed his chief support and that of his companions for ten or twelve days, during his adventurous expedition. This farina is esteemed as a useful medicine in moderating alvine fluxes, and it forms an important article of commerce at Cairo, under the name of *Earth of Lemnos.* The juice is made into an agreeable syrup, serviceable in malignant fevers; and the spoiled fruit when burned, and the lees boiled with rancid palm-oil, is made into a soap that is used by the negroes.

(3668.) *Helicteres,* the screw-tree, is so called from the torsion of its carpels. The fruit of *Helicteres Isora* is made into an unguent with castor-oil, in India, which is said to be useful in healing ulcerations of the ears. A decoction of its leaves and fruit is esteemed as a tonic, and reputed to be serviceable in hectic fevers, and for restoring strength without increasing the cough in consumptive patients. The roots of *H. sacarolha* are also affirmed to be of use in certain cachectic disorders.

(3669.) *Carolinea princeps* has an esculent fruit, but it is undigestible if eaten raw in any quantities; some of the species of this genus have the seeds covered with wool instead of pulp, but it has not hitherto been used in the arts.

(3670.) Bombax Ceiba is the silky cotton-tree of South America; its wool, which is very soft, has been made into hats and bonnets, and used instead of lint; it is also commonly employed by the poorer people to stuff cushions and chairs, but it is in general reputed to be unwholesome to lie on when made into beds. The tree is very large and the wood light; whole trunks are commonly scooped out and converted into canoes, which will carry from 15 to 20 hogsheads of sugar, of six to twelve cwt. each, hence being of the average burden of 25 tons. In Columbus' first voyage, an account is given of a canoe seen in the island of Cuba made of one of these trees, that was 95 palms long, of a proportionable width, and capable of containing 150 men. Some writers have affirmed that the larger trees cannot be compassed by 16 men with their arms extended, and that their height is so great as even to exceed an arrow's flight. When old, the decayed trunk of the Ceiba becomes the prey of the larva of the Macaca beetle; and this caterpillar, when gutted and fried, is esteemed by occidental epicures as one of the greatest delicacies.

(3671.) The roots of *B. Ceiba* are said to be slightly aperient, and those of *B. Malabaricus* emetic. The seeds of *B. pentandrum* are esculent, and a gum exuded from the trunk of this tree is said by Ainslie to be employed in combination with aromatics in diarrhœa, and other intestinal disorders.

(3672.) The wool of several species of *Eriodendron* and *Chorisia* is used for uffing beds and cushions, and that of *Ochroma lagopus* substituted for beaver.

C. ventrica is remarkable for the peculiarity of its growth, (3362.) *Cheirostemon*, the curious hand-plant, is also deserving notice; for, from the monadelphous stamens being 5-cleft, and the five bundles being turned all to one side, it resembles the five claws of a bird's foot, protruding from the calyx. The petals are wanting in this genus.

(3673.) Bromaceæ. The chocolate (*Theobroma*), and various other allies of the mallows, many of which were formerly included amongst the Malvaceæ, are now associated to form the present type, which is distributable into four subtypes, that are occasionally esteemed as separate orders; and these, from *Dombeya*,

Theobroma Cacao. A. Branch, with leaves, flowers, and fruit. B. Flowers separated, shewing the 2-celled anthers and a single petal, with its saccate unguis and strap-shaped lamina. C. Section of the fruit. D. A seed. E. Section of the same.

Hermannia, *Buttneria*, and *Sterculia*, are called the *Dombeyidæ*, *Hermannidæ*, *Buttneridæ*, and *Sterculidæ*: from which there are sometimes separated the *Wallichidæ* and *Lasiopetalidæ*, that are here considered districts of the *Dombeyidæ* and *Buttneridæ*.

(3674.) Collectively considered, the *Bromaceæ* are shrubs or trees, with simple alternate stipulate leaves, and often stellate pubescence. The inflorescence is axillary or opposite the leaves, and racemose, and the flowers regular or irregular, sometimes separate, but usually united.

The calyx is naked or calyculate, formed of five sepals, more or less connate by their bases, and valvate in æstivation. The petals are five or none, contorted in æstivation, regular, sometimes being saccate below and ligulate at the apex, or irregular. The stamens are equal to, or double, or some multiple, of the petals in number; the filaments for the most part monadelphous, but variously

conjoined, and the tube formed by their union often bears also petaloid or barren stamens, intermediate to the fertile ones. The anthers are 2-celled, extrorse, and burst longitudinally by chinks. The germen is formed of 3-5 carpels, more or less closely connate, each cell containing 2-3 or more ascending ovules, attached to the internal angles. The styles are free, or slightly connate, and the stigmata simple.

The fruit is a globose capsule, in general accompanied by the persistent calyx, with 3-5 cells, and mostly dehiscent by valves, rarely indehiscent. The seeds are two or more, with strophiola, and often winged; the embryo included, straight or curved, the albumen fleshy, and sometimes oily, seldom absent, the radicle inferior, and the cotyledons either foliaceous, flat and plaited, or rolled round the plumula; when the albumen is absent the cotyledons are very thick.

(3675.) Hence, differentially considered, the *Bromaceæ* are *Malvianæ*, with stellate pubescence, valvate sepals, monadelphous stamens, 2-celled anthers, dehiscent lengthwise, several celled ovary, and axial placentæ.

(3676.) The following are the chief differential characters of the four subtypes.

(3677.) The *Dombeyidæ* are *Bromaceæ*, with a persistent calyx, flat petals, many monadelphous stamens, and fleshy albumen.

(3678.) The *Hermannidæ* are herbaceous or fruticose *Bromaceæ*, with a tubular persistent calyx, flat petals, definite stamens (5), opposite the petals, many seeds in each cell, a fleshy farinaceous albumen, and mostly a curved embryo.

(3679.) The *Buttneridæ* are fruticose or arboreous *Bromaceæ*, with persistent sepals, irregular, hollow, arched petals, sometimes small or abortive, and the albumen occasionally absent.

(3680.) The *Sterculidæ* are arboreous *Bromaceæ* with a deciduous calyx, petals often absent, flowers mostly separate, filaments in general connected into a long tube, bearing the anthers at its apex; the fruit deeply lobed or concrete, the albumen fleshy, and the embryo erect and axile.

(3681.) The *Bromaceæ*, sometimes called *Sterculiaceæ*, (which is however a very inappropriate collective name, as few of them are fetid, and most of them afford agreeably aromatic food,) are without exception innocuous plants; and, like their allies, the *Malvaceæ*, are chiefly remarkable for their harmlessness, and the abundance of bland mucilage they contain.

(3682.) STERCULIDÆ. The Romans, in the wantonness of Pagan imagination, deified the most obscene actions and filthy objects; and the *Sterculiæ*, some of which have fetid leaves, are memorials of their folly, having been named after their god *Sterculius*. The leaves and flowers of *S. fetida* have, when bruised, an offensive odor; they are used medicinally as aperients, diuretics, and diaphoretics; the seeds are oily, and are said, when eaten raw, to bring on nausea. The wood is of a pale colour, durable, and does not split. It is hence much valued by turners. The seeds of *S. Balanghas* are eaten in Amboyna, and the capsules are burned to make the pigment there called *Cassoumba*.

The *Chicas* of Brazil are the seeds of *S. Chica*; they are of a large size, and have an agreeable smell, and from them, as well as from most of the other *Sterculiæ*, an oil may be expressed, fit both for food and burning; although the slight acridity of the seeds renders it less applicable to the former than to the latter purpose.

The Cola or Kola nuts, once so much valued in Guinea that fifty would pur-

chase a wife, are the seeds of *S. acuminata*. They are about the size of a pigeon's egg, of a bitter taste, and are still esteemed as tonics and stomachics; but their value in relation to the female sex has very much decreased of late years, for now 20 or 30 can be bought for a handful of cowries, and a handsome wife costs upwards of three tons of cowries. *S. pubescens* yields a gum resembling gum tragacanth, and a similar secretion of Cerasin is found to prevail in other species. *S. urens* has a very astringent bark, and its capsule is covered with stinging hairs; its seeds, like those of most of its allies, are eatable, and when roasted resemble parched peas in taste. In India its wood is made into musical instruments.

(3683.) The *Sterculidæ* afford some interesting variations in the development of their fruit. In *Triphaca* and *Reevesia* the carpels are connate; in *Sterculia* and *Erythropsis* they are discrete; while in *Waltheria* only one carpel is developed, the other four being abortive. *Sterculia* also often gives some excellent proofs of the conversion of a leaf into a carpel, by opening at maturity, and assuming, as in *S. platanifolia*, the form of coriaceous leaves, bearing the placentæ and seeds upon their margins.

(3684.) *Buttneridæ.* Some slight variations in structure cause two districts to be recognized in this subtype; the one called *Lasiopetaleæ*, and the other *Buttnerieæ*, from *Lasiopetalum*, and *Buttneria*, the respective normal genera of each.

(3685.) In the *Lasiopetaleæ* the sepals are petaloid, the petals minute, scale-like or wanting, the filaments awl-shaped and connate at the base, either 5, opposite the petals, or 10, alternately barren and fertile, ovules 2-8, and albumen fleshy;

(3686.) While in the *Buttnerieæ* the petals are arched or saccate at the base, and strap-shaped at the apex; the five sterile stamens ligulate and opposite the petals, the fertile ones alternate to them; seeds usually two, and the albumen sometimes abortive.

(3687.) *Theobroma*, *Bubroma*, and *Abroma*, are names given to three genera included in this subtype, the first of which would seem to have been so much relished that it was declared by its European discoverers to be *food fit for gods:* to mark their sense of the inferiority of the second, which, however, is far from despicable, it was called *Bubroma*, or ox's fodder; and the third (*Abroma*), the fruit of which is not eatable, was said to be fit for food neither for gods nor beasts.

(3688.) *Theobroma Cacao* is the plant the seeds of which, when dried and powdered, are known as *cacao*, (improperly called *cocoa*, the similarity of the words having led to the confusion;) and *cacao*, when prepared by the admixture of *arnatto* and certain spices, according to the taste of the inhabitants of different countries, forms that delicious and nourishing food called chocolate; *chococalt* being the Mexican name of the beverage. In South America *Cacao* forms one of the staple provisions of the inhabitants, and large quantities are supplied to sailors in the British navy. The chocolate manufacture in England is confined to very few hands, and its consumption until lately limited by most oppressive duties. Soap is said to enter into its preparation, and that to this material it owes the frothing quality so much esteemed by those who drink it. Humboldt estimates that about 23,000,000 lbs. of chocolate are imported into Europe, the greater part of which is consumed in Spain. The facility with which it can be

conveyed and prepared, when wanted to be eaten, makes chocolate a most valuable and favorite food for travellers. Humboldt says that it is chocolate and maize-flour that have rendered accessible to man the stupendous table-lands of the Andes, and enabled him to penetrate the vast uninhabited forests of central America.

(3689.) The *Bubromæ* are now generally called *Guazumæ*, which is their original Mexican name. The mucilaginous pulp with which the fruit of *G. ulmifolia* is filled has an agreeable taste, something resembling that of green figs; it is chiefly however used not as food by man, but given to cattle; and, during dry weather, when the herbage is scorched up or exhausted, it forms a very grateful and useful fodder. The wood is light and easily worked, the bark is bitter and glutinous, and a decoction of it is said to be serviceable in that frightful disease *Elephantiasis*. It is also used, on account of the quantity of mucilage it contains, in the clarification of sugar.

(3690.) *Hermannidæ*. The genera here associated have hitherto been applied to but few economical or medicinal uses. The bark of *Waltheria Duradinha*, which, like that of *W. viscosissima*, abounds with a strong mucilage, has been employed as a demulcent, and also as a vulnerary: it is likewise held in some repute in Brazil, for its influence in allaying inflammatory symptoms in enfeebled habits and cachectic persons.

(3691.) *Dombeyidæ*. This subtype is distributable into two districts, called, from *Wallichia* and *Dombeya*, the *Wallichieæ* and *Dombeyeæ*; which differ in the following particulars:

(3692.) In the *Wallichieæ* the calyx is involucrate, the stamina pluriseriate, and the monadelphous tube long;

(3693.) While in the *Dombeyeæ* the calyx is destitute of involucrum, the monadelphous stamens uniseriate, and rarely all fertile.

(3694.) The properties of the *Dombeyidæ*, as far as they have been ascertained, are similar to those of the preceding subtypes. *Wallichia spectabilis* is a handsome tree, having much the port of our linden, and hence marks the transition from this type to the *Tiliaceæ*, which follows.

(3695.) Tiliaceæ. The linden or lime-tree, *Tilia*, with its allies, *Elæocarpus* and *Dipterocarpus*, are the normal genera of three subordinate groups, included in the present type, and called the *Tilidæ*, *Elæocarpidæ*, and *Dipterocarpidæ*.

(3696.) Collectively described, the *Tiliaceæ* are trees or shrubs, seldom herbaceous plants, with simple, alternate, rarely opposite leaves, and deciduous stipules.

The inflorescence is axillary or terminal, racemose or paniculate, seldom solitary, and the flowers are regular and united.

The calyx is formed of 4-5 sepals (rarely more or less), free or connate, and valvate in æstivation; usually without an involucrum. The petals (rarely wanting) are equal in number to the sepals, and alternate to them, combined at the base, or free and furnished with foveolæ, imbricate in æstivation in two subtypes, and contorted in the third. The stamens are indefinite and distinct, or but slightly connate at the base, many of the filaments sometimes being sterile, and the anthers 2-celled and dehiscent lengthwise, or by oblong pores at the apex. The germen is formed of 2-10 carpels, rarely more, connate, and 2- or many-ovuled.

The styles, when present, either free or connate, and with the stigmata equal in number to the carpels.

The fruit is dry or baccate, and either dehiscent or indehiscent, of several cells, or by abortion 1-celled; the seeds 2 or more in each cell, erect or pendulous, and often arillate, the albumen fleshy, and the embryo erect in two subtypes, in the third the embryo is pendulous and the albumen absent.

(3697.) Hence, selecting the chief differential characters, the *Tiliaceæ* are arborescent *Malvianæ*, with simple leaves, deciduous stipules, deciduous or connate sepals, many free or but slightly connate stamens, concrete carpella, a several-celled ovarium, 2 or many seeds, rarely reduced to 1 by abortion.

(3698.) The three subtypes distinguishable in this group [§ 3592], differ in the following particulars:

(3699.) In the *Tilidæ* the stamens and sepals are free; there are hypogynous glands between the petals and the ovary, the anthers burst by chinks, and the seeds are many and albuminous.

(3700.) The *Elæocarpidæ* resemble the *Tilidæ* in every respect save that the petals are lobed or fringed, and the anthers open by oblong pores at the apex;

(3701.) While, in the *Dipterocarpidæ*, the calyx is tubular, the petals are contorted in æstivation (like the Malvaceæ), the stamens slightly connected at the base, the anthers dehiscing (like the Elæocarpidæ) by pores, but the seeds solitary and exalbuminous, and the radicle superior. They are also resiniferous trees, while those contained in the preceding subtypes are mucilaginous plants.

(3702.) *Tilidæ.* Although less viscid than the Malvaceæ, these are all mucilaginous harmless plants. Some few, as *Corchorus olitorius*, the *Mauve de Juif*, are used as potherbs, and the flowers and leaves of others, as the lime or linden, *Tilia*, and the *Triumfeta semitriloba*, as demulcent pectoral medicines. The bark of most of these plants is tough and strong, easily separable into layers, which are known in commerce as bass, and from which, in many countries, mats, baskets, and cords, are made. Linden or lime-trees grow to an enormous size, and one of great magnitude is said to have given its Swedish name *Linn* to the ancestors of Linn-eus, who resided in its neighbourhood. Lime timber being light, soft, smooth, close-grained, and not liable to be worm-eaten, is valued by carvers for ornamental works; the screens and carved figures in cathedrals and palaces are chiefly made of lime-wood. Tablets of lime-wood were formerly used for writing on, and the smaller pieces are sought for by turners, and toy and pill box makers. Lime-wood forms also one of the best charcoals for the manufacture of gunpowder, and for making painters' scribblets. The lime-nuts are said, when roasted, to have something the flavour of chocolate, for which they might make a domestic substitute, and the sap abounds with saccharine matter, from which a good sugar has been extracted, and a pleasant wine produced by fermentation. The lime-tree flowers are very fragrant, and are a favorite resort of bees. In Lithuania, near Kowno, where there are large forests of these trees, the honey is proverbially excellent; and *Kowno* honey fetches in the market double the price of that from other places.

There are some famous old trees (a variety of *T. platyphylla*), growing in the churchyard of Seidlitz, in Bohemia, the broad leaves of which are cucullate; and the peasants affirm that they have miraculously borne hooded leaves ever since the monks from a neighbouring convent were hanged upon them.

(3703.) The bark of *Corchorus capsularis* is also tough and flexible, and is often twisted into cords and fishing-lines. The very ornamental shrub, known commonly as *Corchorus Japonicus*, is a species of *Kerria* (*K. Japonica*), and belongs to the type *Spireaceæ* of the *Rosinæ*.

(3704.) *Elæocarpidæ*, the *Perim-kara* of Malabar, is a species of *Elæocarpus*, the fruit of which is eatable, and its stones, which have rough and apparently sculptured surfaces, are often brought to this country, and set in gold for necklaces. The other genera are believed to be innocuous plants, but very little is known of their properties, save that the bark and leaves of *Decadia aluminosa* are used in Cochin-china by the native dyers, to fix and heighten colours, as other mordaunts are by us.

(3705.) *Dipterocarpidæ*. *Dipterocarpus*, *Dryobalanops*, *Shorea*, and their allies, form a small group of resiniferous trees, sometimes associated with the *Garciniaceæ*, sometimes with the *Rutinæ*, but most frequently, and with apparently most propriety, included in the present section. Their affinities with the other groups are, however, by no means to be neglected.

(3706.) *Dipterocarpus turbinatus* is famous throughout the eastern parts of India for yielding a thin liquid balsam, there called wood-oil, which is in great request for common painting.

(3707.) *Shorea robusta* is a noble tree, growing in Hindustan to the height of 100 or 150 feet, and affording excellent timber for domestic architecture; it is, however, far inferior to teak in durability. The wood abounds in resin, which is extracted, and used instead of pitch in the dockyards, where it is called dhammar. The best specimens are also sometimes sorted out and substituted for benzoin, in the incense burned by the Hindus in their temples. Another kind of dhammar is procured from the *Vateria Indica*, the old *Elæocarpus Copalliferus*, and this resin, being solid, goes commonly under the name of Indian copal; the best specimens are often made into ornaments, and sold as *kahroba* or amber. The fruit of this tree, called *Piney*, when boiled, yields a fatty matter, applicable in domestic economy to the same purposes as common tallow.

(3708.) *Dryobalanops Camphora*, the celebrated camphor-tree of Sumatra, is the plant from which our chief supplies of camphor will probably be hereafter drawn. Camphor is yielded in larger or smaller quantities by several plants, such as the *Laurus Camphora*, and other species of laurel; it also is found in the roots of the *Alpiniæ*, *Galangæ*, *Amoma*, &c. as well as in the resins and turpentines procured from some of the Coniferæ. The camphor is found naturally laid up in this tree in large cryptæ, a foot or a foot and a half long; and there are a race of men, styled *Toongoo Nyr-Cappoor*, who pretend to have the power of distinguishing those trees in which the cryptæ are large and full from those the felling of which would be unprofitable toil. Many, however, are mutilated without avail, notwithstanding the pretensions of the seers, and sometimes the cavities are found filled with a pitch-like matter, instead of camphor and fragrant oil. The camphor from the *Dryobalanops* (which is probably only a species of *Dipterocarpus*), is said to be more pure than that from other sources, but less volatile than that of the camphor-laurel.

CAMELLIANÆ.

(3709.) The *Chlenaceæ* and *Theaceæ*, the two types included in this subsection, besides their obvious relationship to the *Malvaceæ*, shew likewise an affinity

to several other groups, especially to the *Hypericianæ* and *Aurantianæ;* and to one type of the former, the *Garciniaceæ,* the *Theaceæ* are most closely connected; but from which their alternate leaves, the quinary arrangement of their flowers, distinct sepals and petals, contorted æstivation of the corolla, and large non-adherent cotyledons, will readily distinguish them.

(3710.) Chlænaceæ. The five genera associated to form this type are shrubs or small trees, natives of Madagascar, with simple, entire, alternate, and deciduous stipules. The inflorescence is racemose or paniculate, and the flowers united and mostly invested with bracteæ, forming a cloak (*χλαινα*), whence the collective name.

The involucrum is 1-2-flowered and permanent, but various in its form and consistence. The sepals 3, small, and imbricate in æstivation. The petals 5-6, broadest at base, and sometimes subconnate. The stamens in general indefinite, but occasionally definite (10). The filaments monadelphous or adhering to the tube of the petals; the anthers roundish and 2-celled, adnate or free, and dehiscent longitudinally by chinks. The germen is 3-5-celled, formed of 3, rarely 5 connate carpels, with many-ovuled central placentæ. The style is filiform, and the stigma trifid.

The fruit is capsular, 3-celled, or from abortion 1-celled; the seeds solitary or numerous, and pendulous from the central placentæ; the albumen is fleshy or corneous, the embryo green and central, and the cotyledons foliaceous and wavy.

(3711.) Hence, differentially considered, the *Chlænaceæ* are trisepalous *Camellianæ,* with monadelphous stamens, suspended albuminous seeds, green central embryo, and mostly stipulate leaves.

(3712.) The *Chlænaceæ* are evidently a transitional group from the mallows to the camellias and their allies; their involucrate flowers and monadelphous stamens indicate their affinity; and although, from the slight union of their petals and albuminous seeds, they were referred by Jussieu to the neighbourhood of the *Ebenaceæ,* they certainly appear, as Du Pettit Thouars has observed, to be more nearly related to the Malvaceæ than to any other group; and yet from them they are at once distinguished by the imbricated æstivation of their sepals, their 2-celled anthers with a longitudinal dehiscence, and their albuminous seeds.

(3713.) The *Chlenaceæ* are handsome plants with shewy blossoms, but of their properties there is nothing known; most of the genera have involucrate flowers and capsular fruits; but one, viz. *Hugonia,* is destitute of involucrum, and its fruit is baccate; hence the group is probably distributable into two subtypes.

(3714.) Theaceæ. The *Tea* plant and its typical associates are trees or shrubs, with coriaceous penninerved, simple, alternate (rarely opposite) leaves, destitute of stipules. The inflorescence is axillary or terminal, solitary or aggregate, united or polygamous by abortion, and variable in colour.

The calyx is formed of 5-7, unequal, coriaceous sepals, imbricate in æstivation, and often subinvolucrate. The petals usually 5, (seldom more or less,) are free or slightly connate at the base, and imbricate or subcontorted in æstivation. The stamens are indefinite, the filaments more or less connate, either mon- or polyadelphous, and the anthers versatile or adnate, 2-4 celled, and dehiscent either by pores or clefts. The germen is formed of several connate carpels, (2-7,) the placentæ are axial and few or many-ovuled, the styles 3-7, filiform, and free or more or less combined.

The fruit is capsular, either fleshy or coriaceous, dehiscent or indehiscent, and

many-celled; the cells are usually equal in number to the styles, but the fruit is sometimes 1-celled by the imperfection of the dissepiments. The seeds are large, in general few, sometimes arillate, and attached to the axial placentæ; the albumen absent, or in small quantity, the embryo straight, bowed, or folded back, the radicle turned towards the hilum, and the cotyledons large, sometimes plicate, and often oily.

(3715.) Hence, selecting the chief differential characters, the *Theaceæ* are exstipulate subinvolucrate *Camellianæ*, with mon- or poly-adelphous stamens, and exalbuminous or subalbuminous definite seeds.

(3716.) The genera associated to form this type are distributable into two subtypes, called, from *Ternströmia* and *Camellia*, the *Ternströmidæ* and *Camellidæ;* and the former has been again subdivided into several districts by De Candolle; but the later investigations of Cambessèdes render it doubtful whether these subdivisions are tenable, and, according to him, the two subtypes just named are scarcely separable.

(3717.) The Ternströmidæ have, according to Bartling, a 5-sepaled persistent calyx, 5 petals, and sometimes albuminous seeds;

(3718.) While, in the *Camellidæ*, the calyx is 5-7 sepaled and deciduous, and the seeds are exalbuminous.

(3719.) *Ternströmidæ.* As far as experience and analogy instruct us, the plants contained in this subtype are innocuous: they are mucilaginous, slightly bitter and aromatic, and some few have been used in fomentations and the preparation of emollient baths, such as *Kielmeyra speciosa;* and *Cochlospermum insigne* in decoction is said to have the power of healing internal abcesses. It is called *Batua do curvo* in Brazil. The fruit of some of the *Saurajeæ* is esculent, and one is said to resemble the Tomato in flavor.

(3720.) *Camellidæ.* This subtype contains only two genera, viz. *Camellia* and *Thea*, and even these are by some persons not considered as generically distinct. The *Camelliæ* are celebrated for the great beauty of their foliage and the splendid colours of their blossoms, which vary through every shade and mixture of red and white. In its native country the *Camellia Japonica* is a lofty tree, and even in our conservatories it reaches, under favourable circumstances, a considerable size. The seeds of several species abound in oil, which may be expressed for table use; and that procured from *C. oleifera* is said to be equal, if not superior, to olive oil. *C. drupifera* also yields abundance of oil, which when fresh is excellent, but it soon becomes rancid. *C. Kissi* is the *Kengna* or *Kissiswa* of Hindustan, and its leaves have a strong smell, like that of China tea, but it is transient, and the flavor is inferior to the true Theæ.

(3721.) Of the genus *Thea* there are but three or four known species, and of these two only, viz. *T. viridis* and *T. Bohea,* afford the leaves which are so extensively used in infusion, as the common morning and evening beverage in this country, and in other parts of Europe, as well as in China. Indeed, some authorities declare, that the black and green teas are not the produce of different species, but merely varieties of *T. viridis,* which, according to soil and culture, will produce either green tea or black; and that the *T. Bohea* of botanists does not enter essentially into the manufacture, although its leaves, as well as those of different species of Camellia, may be introduced accidentally, or be mixed designedly as an adulteration. The tea districts of China extend from about the 27th to the 31st

degree of north latitude, but the plant may be cultivated in more northern regions, even to latitude 45° in Japan, where the climate is, however, peculiarly mild for its distance from the equator. The tea plants delight in shallow soils on the sides of hills, and some of the finer kinds are said to grow on such dangerous declivities as to be inaccessible to man, and their leaves are only obtained by the artifice of provoking the monkies that dwell among them, who, when enraged, break off the boughs and fling them at their tormentors below. The black and the green tea districts lie in different provinces, and teas of very various qualities and value are brought from the several districts in which the two chief varieties are principally cultivated; and it is said, that if a green tea plant be transported to a black tea district, it then will bear black tea leaves, and that the contrary occurs when black tea plants are carried to green tea districts. This affirmation appears to be decisive of the question so long debated, as to whether bohea and green teas are the produce of the same or different species. Tea is said to have been first used by the Chinese to cover the taste of their water, which is in many districts brackish and unpalatable, and that, finding the infusion pleasant in its flavor, and enjoying the agreeable excitement it produces, the practice gradually extended even in those places where the water was good, and at length was introduced into Europe. As M'Culloch observes, "the late rise and present magnitude of the British tea trade are among the most extraordinary phenomena in the history of commerce." Tea was wholly unknown to the Greeks and Romans, and even to our own ancestors, previously to the end of the 16th or the beginning of the 17th century. It seems to have been originally imported in small quantities by the Dutch, but was hardly known in this country until after 1650. In 1660, however, it began to be used in coffee-houses, for by an act passed in that year a duty of 8*d*. is laid on every gallon of "coffee, chocolate, sherbet, and *tea*," made and sold. But it is abundantly evident that it was then only beginning to be introduced, for the following entry appears in the Diary of Mr. Pepys, secretary to the admiralty. "September 25, 1661, I sent for a cup of tea, (a China drink,) of which I had never drunk before." In 1664 the East India Company bought 2 lbs. 2 ounces of tea as a present for his Majesty. In 1667 they issued the first order to import tea, directed to their agent at Bantam, to the effect that he should send home 100 lbs. of the best tea he could get; and since then the consumption has gone on regularly increasing, until now the average yearly consumption in Great Britain alone, excluding Ireland and our colonies, is upwards of 26,000,000 lbs. yielding a revenue of between 3 and 4,000,000*l*. per annum.

(3722.) An infusion of the leaves of *T. Cochin-chinensis* is employed in warm weather as a refrigerant; and the seeds of *T. oleosa* are said to yield an abundance of oil, fit for table use as well as for burning; but it is probable that this plant is the same as that described, under the name of *Camellia oleifera*, by Abel.

RANUNCULINÆ.

(3723.) The nine types or natural associations of genera included in this section are distributable into three subsections, which, from *Berberis* (the barberry), *Ranunculus* (the crowfoot), and *Nelumbium* (the water-lotus), are called *Berberianæ*, *Ranunculianæ*, and *Nelumbianæ*.

(3724.) Collectively considered, the *Ranunculinæ* are albuminous *Rhœadosæ*, with imbricate sepals and petals, and indefinite stamens; carpels numerous and

for the most part distinct; the albumen usually large, and the embryo small, and sometimes vitellose.

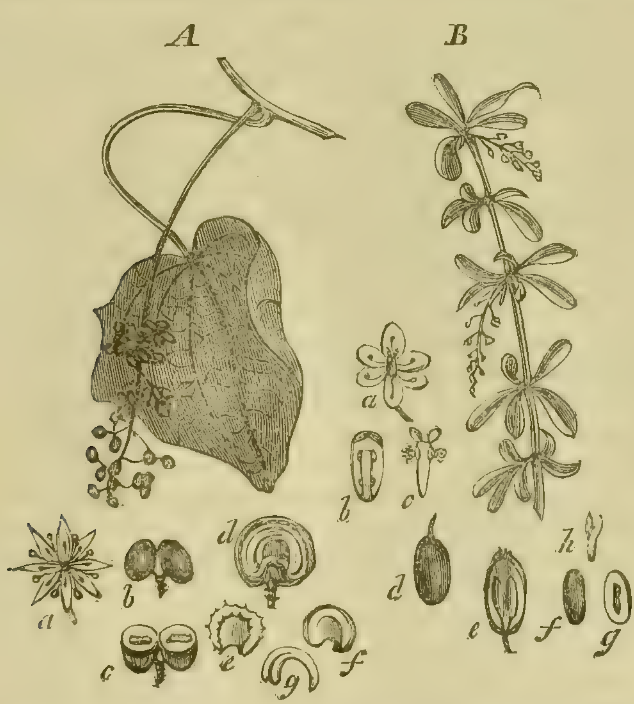
(3725.) The *Berberianæ* are drupaceous *Ranunculinæ*, with deciduous sepals and petals, indefinite stamens, or, when definite, opposite the petals, and the ovaries few or many, and distinct, and the albumen sometimes small.

(3726.) The *Ranunculianæ* are non-drupaceous *Ranunculinæ*, with an imbricate, rarely valvate perianth, indefinite stamens; ovaries mostly indefinite, multiseriate and distinct, the albumen large, and the embryo straight.

(3727.) The *Nelumbianæ* are herbaceous aquatic *Ranunculinæ*, with large floating leaves, carpels distinct or connate, and the embryo enclosed in the persistent vitellus.

BERBERIANÆ.

(3728.) Two types only are comprehended in this subsection; the one called *Menispermaceæ*, from *Menispermum*, the moon-seed, and the other *Berberaceæ*,



A. *Menispermum Canadense*. (*a*) Stamineous flower. (*b*) Fruit, one carpel being abortive. (*c*) Transverse section. (*d*) Longitudinal section of fruit, two carpels being abortive. (*e*) Seed invested with the endocarp. (*f*) Ditto naked. (*g*) The curved embryo.

B. *Berberis vulgaris*. Cutting, to shew the foliage, aculeate stipules, and inflorescence. (*a*) Flower separated and expanded. (*b*) A petal detached. (*c*) A stamen, to shew the valvular dehiscence of the anthers. (*d*) The fruit. (*e*) Ditto cut lengthwise, to shew the two erect seeds. (*f*) A seed. (*g*) Longitudinal section of ditto, to shew the embryo. (*h*) Embryo detached.

from *Berberis*, the common barberry. The affinity of these groups is close, and their connexions with the surrounding ones not slight. De Candolle mentions

their monadelphous stamens as a point of similitude between the *Menispermaceæ* and *Bromaceæ*, and those genera which have stipulate leaves, as *Caperonia*, establish a connexion with the *Malvaceæ*. The *Menispermaceæ* also approach some of the *Anonaceæ*, with which, however, the *Berberaceæ* are perhaps the most intimately connected.

(3729.) Menispermaceæ. The genera associated to form this type are climbing shrubs or perennial herbaceous plants, with alternate, petiolate, and, in general, cordate or peltate leaves, simple, rarely compound, mucronate, and destitute of stipules. The inflorescence is, in general, axillary, racemose or paniculate, the flowers are small, diœcious (by abortion?), rarely monœcious or polygamous.

The sepals and petals are indistinguishable from each other, arranged in ternary or quaternary, seldom in quinary series, and the latter are sometimes abortive. The stamens are usually monadelphous, rarely free, sometimes opposite the petals, and equal to them in number, at others, but less frequently, 2-3 or 4 times as many. The anthers are adnate, and usually adhering throughout their whole length to the filaments, and dehiscent extrorsely. The germen consists of several carpels (or by abortion of a single ovary), subcoalescent by the bases of the styles, which are terminal, and the stigmata simple; sometimes the carpels are connate, the germen multilocular, or by abortion 1-celled.

The fruit is drupaceous or baccate, each carpel 1-seeded, oblique or lunulate, compressed, and the seeds similar to it in form. The embryo is curved or peripheric, (*i.e.* turned in the direction of the circumference.) The albumen, when present, spare and fleshy, (but often absent); the cotyledons are flat, sometimes lying face to face, at others distant, and even situated in separate cells of the seed.

(3730.) Differentially considered, the *Menispermaceæ* are amphipetalous *Berberianæ*, with twining stems, cordate or peltate leaves, small separated flowers, anthers dehiscent by chinks, and a curved embryo.

(3731.) The *Menispermaceæ* are distributable into three subtypes, which, from *Schizandra*, *Lardizabala*, and *Menispermum*, are called the *Schizandridæ*, *Lardizabalidæ*, and *Menispermidæ*.

(3732.) The *Schizandridæ* are albuminous *Menispermaceæ*, with numerous carpella seated on a long conical torus.

(3733.) The *Lardizabalidæ* are exalbuminous *Menispermaceæ*, with compound leaves, and many-celled many-seeded fruits;

(3734.) While the *Menispermidæ* are exalbuminous *Menispermaceæ*, with simple leaves, and 1-celled 1-seeded carpels.

(3735.) *Menispermidæ*. The several species of *Cissampelos*, and other genera, with peltate leaves, shew the affinity of this group with the *Tropæolaceæ* of the preceding section. *C. Pareira* is the true *Pareira brava* of medicine, once much esteemed in ischuria and various diseases of the bladder. It is a bittersweet diuretic, but not at present often employed. *C. Mauritania* and *Abuta candicans* and *rufescens* have similar properties, though in a less degree, and their roots are often mixed with those of the real *Pareira brava*. The roots of *C. ebracteata*, the *Orelha de Onca* of Brazil, is there considered as an antidote against serpent-bites; and those of *C. ovalifolia*, which are very bitter, are said to be an effectual remedy in cases of intermittent fevers. The peltate leaves of *C. glaberrima* have a stimulating smell and a pungent taste, resembling those of the trophy cress.

(3736.) *Calumba* or Colomba-root, so much prized as an astringent stomachic bitter, and which has been so successfully employed in the cure of dysentery and severe cases of diarrhœa, is the root of the *Cocculus* (or Menispermum) *palmatus*. Several other species of *Cocculus*, as *C. cordifolius*, *C. platyphyllus*, *C. peltatus*, *C. cinerascens*, and *C. crispus*, are also commended as valuable tonics.

(3737.) The berries of others, as *C. flavescens*, *C. Plukenetii*, *C. lacunosus*, and *C. suberosus*, are deleterious, and are frequently used to intoxicate or poison fish. The latter affords the well-known deadly drug called *Cocculus Indicus*, which is here often employed to destroy vermin, and also by poachers to capture fish. This, its chief Indian use, being forbidden in England by law, it is, as Don says, not easy to account for the large importations of the berries as an article of trade, unless they serve to adulterate fermented liquors, and to impart to beer an adventitious intoxicating quality. Such frauds are however prohibited under heavy penalties. The active principle of *Cocculus Indicus* is believed to be an alkaloid, which has been separated, and is called *Picrotoxia*: M. Boullay has also detected a peculiar acid in the berries, which he has named the *Menispermic*. *Cocculus Indicus* has been recommended in the treatment of paralysis, and in some cases its administration would seem to have been serviceable in restoring lost power to palsied limbs.

(3738.) The bruised stems of *C. fibraurea* yield a yellow dye, which is used instead of turmeric, but its colour is neither so bright nor durable. The roots and stems are also esteemed as diuretics and deobstruents. *Coscinium fenestratum* is the "*knotted plant*," or *Bangwell-gettah*, of the Cingalese, who swallow small slices of the wood in decoction, considering it an admirable stomachic.

(3739.) *Lardizabalidæ*. The fruits of *Holböllia latifolia* and *H. angustifolia*, natives of Nepal, are both eatable; as is also that of *Lardizabala biternata*, which is sold in the markets of Peru and Chili under the names of *Guilbogui* or *Coguillvochi*.

(3740.) *Schizandridæ*. The properties of these plants are as yet unknown; and they are at present chiefly interesting on account of the connexion they establish, by their albuminous seeds, between this type and the *Annonaceæ* of the following subsection, to which by some writers they are appended.

(3741.) Berberaceæ. *Berberis*, and its typical associates, are shrubs or perennial herbaceous plants, for the most part smooth, and with simple or compound, alternate leaves, destitute of stipules. The inflorescence is racemose or paniculate, sometimes solitary, and the flowers regular and united. The sepals are 6 (4 or 3) biseriate, deciduous, and furnished externally with petaloid scales. The petals equal in number to the sepals, and opposite to them, (seldom twice as many,) and in general with an appendage internally at their bases; the stamens are equal to the petals in number, and opposite to them; the filaments are short, free, and sometimes irritable; the anthers oblong, adnate, 2-celled, and dehiscent by elastically recurving valves. The germen is 1-celled and many-ovuled, the style subterminal and very short, and the stigma thick and suborbiculate. The fruit is baccate or capsular, and 1-celled; the seeds 2-3, seldom solitary, are usually attached to the lower part of the lateral placenta, and are erect or suboblique. The albumen fleshy or subcorneous, the embryo straight, axile, and slender, with the radicle more or less thickened at its extremity, and the cotyledons flat.

(3742.) Hence, differentially considered, the *Berberaceæ* are non-scandent

Berberianæ with united flowers, the stamens and petals opposite the sepals, the anthers dehiscent by recurved elastic valves, the carpels solitary, the seeds albuminous, and the embryo straight.

(3743.) The Berberaceæ are all innocuous plants; the fruits of several, as of the common barberry, are eatable. They are in general acid, and more or less astringent. The acid present in the barberry is the oxalic, and it renders the fruit so sour that but few birds will eat it. When preserved with sugar, it is however excellent as a dessert, or pickled as a garnish. A very refreshing drink is made by bruising the berries and steeping them in water, which is considered serviceable in fevers. The barberry was once an officinal plant, but it has been long expunged from our Pharmacopœias. The astringent principle is so abundant in the bark of *Berberis vulgaris* that it is used in Poland to tan leather. It also affords, with alum, a beautiful yellow dye. *Berberis tinctoria* and *lutea* are likewise used as yellow dye-stuffs; and the wood of *B. ilicifolia*, from its elasticity, is made into bows by the inhabitants of Terra del Fuego.

(3744.) A prejudice exists against the growth of the barberry in hedges or near corn-fields, as it is said to render the corn in its vicinity, and even to the distance of 3 or 400 yards across a field, barren. There seems, however, to be but little foundation for the belief that this sterility is attributable to the barberry.

(3745.) The barberry is remarkable for the conversion of the lower leaflets of its compound leaves into spinacules by the abortion of the sarcophyl, and the induration of the ribs or pleurophyl. These spiny leaflets, as well as those which retain the ordinary development, are articulated with the petiole.

(3746.) *Leontice thalictroides* likewise requires especial notice, from the peculiarity of its ovary not enlarging with the growth of the seeds, which hence, in their progress towards maturity, burst through the stunted pericarp, and become absolutely naked when ripe, although invested with a pericarpial covering when young.

RANUNCULIANÆ.

(3747.) Five types or natural families of plants are included in this subsection; the three first of which should probably however be regarded as only subdivisions of a common type. *Anona*, *Magnolia*, *Dillenia*, *Ranunculus*, and *Pæonia*, the normal genera of these several types, give their names to each respectively.

(3748.) Anonaceæ. The custard apple (Anona), with its typical allies, are trees or shrubs, bearing alternate, simple, entire, exstipulate leaves. The inflorescence is axillary, sometimes opposite the leaves, the peduncles short, and one or few flowered, and the flowers united and regular.

The calyx is formed of 3-4 persistent sepals, usually connate, (rarely free,) and imbricate in æstivation. The petals are 6, biseriate, alternate with each other, coriaceous, and valvate in æstivation, sometimes (but rarely) wanting; the stamens are indefinite, (seldom definite, as in *Bocagea*,) adpressed, and covering a large hypogynous disk. They are free, short, more or less angular, the anthers adnate, extrorse, and dehiscent longitudinally, with a glandular connectivum that is often large, 4-cornered, and nectariferous. The carpels are numerous, (seldom solitary, as in Monodora,) the styles are short, and the stigma simple. The fruit consists of numerous carpels, (rarely by abortion few or solitary,) either succulent or dry, stalked or sessile, discrete or coadunate, and 1 or many-seeded.

The seeds are ovate or ovato-oblong, attached to the sutural placenta in one or two rows. The testa is membrano-crustaceous and brittle. The tegmen membranous and folded inwards, or forming many processes, entering the albumen,

A. *Ranunculus acris.* Specimen to shew the root, exstipulate leaves, with expanded petioles and flowers. (*a*) Flower separate. (*b*) Numerous carpella. (*c*) One carpel separated. (*d*) Section of ditto, to shew the albumen and embryo.

B. *Hibbertia volubilis.* Cutting, to shew leaves and flower. (*a*) Flower deprived of the petals to shew the alternate sepals; one stamen only left with the pistils. (*b*) The aggregate carpels. (*c*) A seed, with its incomplete arillus. (*d*) Section of the seed, to shew the albumen and small erect embryo.

C. *Anona squamosa.* Cutting, to shew leaves without stipules, and the ternary arrangement of the flowers. (*a*) Flower separated, the ternary disposition of the perianth, and numerous stamens. (*b*) Fruit. (*c*) Section of ditto. (*d*) Seed. (*e*) Ditto with the tegument removed. (*f*) Section to shew the ruminated albumen. (*g*) The embryo.

which hence is ruminated. The embryo is small and seated at the base of the rimose albumen, which is hard and fleshy, the cotyledons short and entire, and the radicle subrotund.

(3749.) Differentially considered, the *Anonaceæ* are therefore syn- or apocarpous *Ranunculianæ*, with exstipulate leaves, rimose anthers, and ruminated albumen.

(3750.) Three chief variations are noticeable in the structure of the fruit of the *Anonaceæ*, which are characteristic of three districts, in which the included genera may be arranged.

(3751.) MONODOREÆ. In *Monodora* the fruit is formed of a solitary carpellum. *Eupomatia*, generally referred to this group on account of its solitary fruit, which

is many-celled, has perigynous stamens, and is destitute of petals; the propriety of its location here is therefore doubtful.

(3752.) *Anoneæ.* In *Anona* and *Rollinia* the carpels are numerous and coadunate;

(3753.) While in *Unona,* and all the other genera that together form the district *Unoneæ,* the carpels are numerous and discrete.

(3754.) The *Anonaceæ* are in general powerfully aromatic plants, and the fruit of many much esteemed as food. *Anona muricata* is the sour-sop, *A. squamosa* the sweet-sop [§ 3748, c], and other species the different kinds of custard and alligator apples of tropical countries. *A. Cheirimolia* is one of the most delicate Peruvian fruits, and said to be not inferior to any in the world.

The wood of *A. palustris* is so soft that it is often used as stopples instead of cork, and that of *A. sylvatica* being white and easily worked, is sought after by turners as lime-wood is in Europe.

(3755.) *Asiminia triloba* is sour, and has a fetid smell; the fruit is therefore seldom eaten excepting by the negroes. Du Hamel says it contains a peculiar and very powerful acid.

(3756.) The dry fruits of some *Unoneæ,* as *Unona aromatica* and *Æthiopica,* which latter is the *Piper Æthiopicum* of commerce, are very pungent, and often substituted for other spices. *Xylopia frutescens* has also an aromatic fruit, with the pungency and something the flavour of pepper. The fruits of other *Unonæ* are esculent. From *U. Narum* a sweet-smelling greenish oil is procured by distilling the roots, which is used medicinally as a stimulant. Its bark, as well as that of *U. musaria,* is used in the construction of musical instruments; and that of *Xylopia sericea,* and several other species, is twisted into cordage. *X. glabra* is the bitter-wood of Jamaica; and, so great is its bitterness, that sugar which has been occasionally imported in hogsheads made of it has been rendered uneatable. Furniture made of it is proof against the attacks of insects; but it is very disagreeable to work with, on account of the bitterness which the carpenters complain of perceiving in their mouths and throats.

The flowers and juices of several *Unonaceæ* are highly fragrant, as *U. virgata, odorata,* &c.; and from the bark of *Uvaria tripetaloidea* when wounded there exudes a viscid secretion which hardens into a fragrant gum.

(3757.) *Bocagea,* which is remarkable for its definite stamens, establishes, by its hexandrous flowers, a connexion between this type and the *Berberaceæ.*

(3758.) Magnoliaceæ. The *Magnoliæ,* and their typical allies, are splendid shrubs or trees, with simple, alternate, penninerved leaves, and convolute deciduous stipules, when young terminating the branches with a conical calyptra, like as in the fig-tree, and when fallen leaving annular cicatrices. The inflorescence is terminal or axillary, the flowers large, solitary, united (very seldom diœcious, as in *Mayna,*) and often intensely fragrant. The parts of the flower have a ternary disposition.

The sepals (3-6) are deciduous, nearly entire, and imbricate in æstivation. Petals 3-27, in one or many ternary series, and imbricate in æstivation. The stamens are indefinite, and exserted from an hypogynous torus. The filaments free, the anthers long, adnate, and 2-celled, with parallel locules dehiscent longitudinally by clefts, and a very narrow connectivum. The ovaries are many, attached to the torus above the stamens, distinct, multiseriate and imbricate,

rarely definite, and uniseriate; each 1-celled, 1 or more ovuled, and the ovules suspended or ascending; the styles are short, and the stigmata simple.

The fruit is either dry or succulent, consisting of numerous carpella, variable in form, and either dehiscent by clefts from above or below, or sometimes indehiscent; and attached to an elongated axis or torus. The seeds are solitary or several, affixed to the inner angle of the carpel, the embryo small, straight, and included in the base of the albumen, which is fleshy, and the radicle is next the hilum.

(3759.) Hence, differentially considered, the *Magnoliaceæ* are stipulate *Ranunculianæ*, with a deciduous calyx, elongated adnate anthers, and many distinct carpella.

(3760.) The genera here associated are distributable into two subtypes, which, from *Magnolia* and *Illicium*, are called the *Magnolidæ* and *Illicidæ*.

(3761.) The *Magnolidæ* include all those genera in which the leaves are impunctate, and the carpels indefinite and spicate;

(3762.) While, in the *Illicidæ*, (or *Wintereæ*,) the juices are aromatic, the leaves pellucido-punctate, and the carpels definite and uniseriate.

(3763.) *Magnolidæ.* The Magnolias, and their several allies, are aromatic bitter plants, with very shewy fragrant blossoms. Indeed, the odor of some, as *M. tripetala* and *M. glauca*, is so powerful and penetrating as to induce sickness and headach, and even, according to Barton, paroxysms of fever, and of gout, so that it strips of its hyperbole the assertion that men might "die of a rose in aromatic pain." Kalm says that these trees may be discovered by their scent at a distance of three miles when the wind is favorable. The bark of *M. glauca*, as well as the other species, is intensely bitter, and is said to be equally efficacious as cinchona in the cure of intermittent fevers. The seeds, which are bitter, are known in America under the name of *Indian physic*: a tincture made from the cones of *M. acuminata* is extolled in Virginia in the treatment of rheumatism, and the bitter seeds of *M. Yulan* are used in China as a febrifuge under the name of *Tsin-y*. *M. excelsa* yields excellent fine-grained timber; and that of *Michelia Doltsopa*, one of the handsomest trees of Nipal, affords also a valuable fragrant wood. *Michelia Champaca* is the *Tsiam paca* of the Asiatics, who are very fond of its aromatic orange-coloured flowers as ornaments for their heads. The root and bark is red and bitter, but the fruit is eatable.

(3764.) *Aromadendron elegans* is a beautiful tree, remarkable for the fragrance of its blossoms; its bark is aromatic and bitter, and it is esteemed medicinally as a stomachic.

(3765.) *Liriodendron Tulipifera* is the tulip-tree now naturalized to our plantations, and deservedly a great favorite in parks from its handsome growth, curious leaves, and beautiful tulip-like flowers. Like the other *Magnolidæ* its wood is useful as timber, being light, fine-grained, and easily worked; and the bark is bitter and tonic. There are two varieties of this plant, the *acutiloba* and *obtusiloba*; the wood of the first is white, and that of the second yellow.

(3766.) *Illicidæ.* Like the preceding subtype, the plants here associated are aromatic bitters; as examples, the *Drimys Winteri* or *Wintera aromatica*, the *Temus moschata*, and the *Illicium anisatum*, may be mentioned. The former yields the true Winter's bark, which was found so beneficial a restorative to the crew of Captain Winter's ship, who accompanied the circumnavigator Drake.

De Weert also says that its aromatic leaves and bark are useful condiments in so cold a climate as Magellan Straits; and in Brazil the aromatic bark of *D. Granatensis* is much esteemed as a spice and as a stimulating tonic. The leaves of *Temus moschata* when bruised smell like nutmegs; and *Illicium anisatum*, the capsules of which have both the flavor and odor of anise, whence indeed its specific name, is known in commerce as *Chinese anise*. In China it is used as a condiment, and chewed after dinner as a stomachic and sweetener of the breath. The bark, when finely powdered, is used by the public watchmen in Japan to make a time-keeper or instrument for measuring the hours, by slowly sparkling at certain spaces in a box, in order to direct when the public bells are to sound.

The bark of *I. Floridianum* is also aromatic and bitter, and might be used for the same purposes as canella and sassafras.

(3767.) DILLENIACEÆ. The genera associated to form this type are evergreen trees, shrubs, or undershrubs, having simple, usually alternate, coriaceous leaves, with costo-marginal costulæ, and almost always exstipulate, (Wormia being the only exception.)

The inflorescence is terminal or lateral, solitary, racemose, or paniculate. The flowers united or separate, for the most part regular, and often yellow.

The calyx is persistent, and formed of 5 sepals, which are imbricate in æstivation: rarely 5-sepaled or with many, as in *Empedoclea*. The petals 4 or 5, are persistent or deciduous, alternate with the sepals, and, like them, imbricate in æstivation. The stamens are numerous, exserted from an hypogynous torus, and either placed regularly round the pistil, or on one side of it. The filaments are free or polyadelphous, dilated either at the base or apex; the anthers are adnate, 2-celled, and introrse, dehiscent inwards or laterally, and usually lengthwise. The ovaries are 1-celled, definite, more or less distinct, occasionally coherent, as in *Dillenia* and *Colbertia*, and sometimes solitary, as in several of the *Delimidæ*. The ovules are numerous and ascending, the styles terminal, equal in number to the carpels, and the stigmata simple.

The fruit consists of from 5 to 2 unilocular carpels, sometimes by abortion reduced to 1. The pericarps are either capsular and 2-valved, or baccate, and surmounted by the persistent styles. The seeds are attached in a double series to the inner edge of the carpels, numerous or only in pairs, or even solitary by abortion; invested by a pulpy arillus, and having a hard testa. The albumen is fleshy or subcartilaginous, and the embryo minute, erect, and basal, with the radicle next the hilum, [§ 3748, B.]

(3768.) Differentially considered, the *Dilleniaceæ* are sempervivent *Ranunculianæ*, with simple exstipulate leaves, persistent sepals, adnate introrse anthers, arillate seeds, and solid albumen.

(3769.) The genera here associated are distributable into two subtypes, called, from *Dillenia* and *Delima*, the *Dillenidæ* (or *Dilleneæ*), and the *Delimidæ* (or *Delimaceæ*.)

(3770.) In the *Dillenidæ* the filaments are not dilated at the apex, the anthers are elongated and adnate, the ovaries 2-5 distinct, rarely solitary, or from 5-20 partially connate. They are also trees or shrubs, very seldom twining, and with flowers often fragrant or fetid.

(3771.) In the *Delimidæ* the filaments are dilated at the apex, forming a broad

connectivum. The cells of the anthers are round and distinct. The ovaries from 1-5, capsular or baccate, and mostly few-seeded. They are also trees or shrubs, with occasionally a twining habit.

(3772.) These plants are very closely allied both to the *Anonaceæ* and *Magnoliaceæ*, from both of which they are however distinguished by their exstipulate leaves and the quinary arrangement of the floral organs; to the Ranunculaceæ they are also intimately connected: from these latter they however differ, not only in habit, but also in their persistent sepals, and have arillate seeds.

(3773.) The *Dilleniaceæ* are in general astringent, like the *Magnoliaceæ*, but none of them contain aromatic juices. The bark and leaves of several, as *Curatella cambäiba*, *Davilla rugosa*, and *D. elliptica*, are used in decoction as astringent lotions; and the last named affords the vulnerary called *Cambäibinha* in Brazil. The fruit of *Dillenia speciosa* is eatable, and the acid juices of other species form with water and sugar very agreeable and refreshing drinks.

(3774.) The leaves of most of the *Delimidæ* are covered with asperities, and some, as *Curatella Americana*, and especially *Trachytella Actæa*, are so scabrous that they resemble shagreen, and are used for cleaning and polishing wood and metals, as fish-skin and sand-paper are in Europe.

(3775.) Ranunculaceæ. The frog-wort or crowfoot (Ranunculus), and its allies, are herbaceous, very seldom shrubby plants, with aqueous juices, round or irregularly angled stems, alternate (rarely opposite), petiolate leaves destitute of stipules, but with the leaf-stalks dilated, and more or less amplexicaul. The lamina is either entire or variously lobed, seldom really compound, sometimes abortive, when the expanded petiole becomes a phyllodium; and the pubescence, when present, is simple.

The inflorescence is variable, either solitary, scattered, racemose or paniculate; the flowers regular or irregular, and united, or occasionally by abortion separate.

The sepals are free, definite, 3-6, deciduous, often petaloid, rarely absent, mostly imbricate in æstivation, seldom valvate or induplicate. The petals are equal in number to the sepals, and alternate with them, or two or three times as many, rarely by abortion absent, often deformed, being transitional towards either sepals or stamens, or nectaries, and imbricate in æstivation. The stamens are indefinite, free, deciduous, and often multiseriate. The anthers are adnate, 2-celled, the connectivum continuous with the filaments, and dehiscent extrorsely by longitudinal chinks. The pistils are numerous, exserted from a torus in one or more series, rarely fewer than the sepals or solitary, the ovaries 1 or more ovuled, the ovules attached to the inner edge, the styles free and terminal, short, and often persistent, and the stigmata simple.

The fruit in general consists of small dry nuts or *akenia*, occasionally becoming baccate, with 1 or more seeds, or capsular with 1 or 2 valves. The seeds are exarillate, when solitary erect or pendulous, when numerous horizontal, and exserted in a double series from the sutural placentæ. The albumen is large and horny, the embryo small, situated in the base of the albumen, and the cotyledons are foliaceous in germination, [§ 3748, A.]

(3776.) Hence, differentially considered, the *Ranunculaceæ* are herbaceous, seldom shrubby *Ranunculianæ*, with exstipulate leaves, dilated petioles, deciduous sepals and petals, extrorse anthers, exarillate seeds, and solid corneous albumen.

(3777.) The *Ranunculaceæ* are distributable into four subordinate groups, which, however, are consonant in so many particulars, that they seem to be more properly considered as districts than subtypes. From *Clematis* (the traveller's joy), *Anemone* (the wind-flower), *Ranunculus* (the frogwort), and *Helleborus* (the Christmas-rose), these districts have been named *Clematideæ, Anemoneæ, Ranunculeæ*, and *Helleboreæ*.

(3778.) The *Clematideæ* are climbing shrubs, rarely herbs, with opposite leaves, valvate or induplicate sepals; petals none or flat, carpels many, free, indehiscent, and 1-seeded, with the styles persistent as caudal appendages, and the seeds pendulous.

(3779.) The *Anemoneæ* are herbaceous, seldom shrubby *Ranunculaceæ*, with the leaves radical or alternate on the stems, sometimes opposite or whorled on the flower-stalks, forming involucra, æstivation imbricate, petals none or flat, carpels many, free, indehiscent and 1-seeded, usually ending in a tail or point, and the seed pendulous.

(3780.) The *Ranunculeæ* are herbaceous, never shrubby *Ranunculaceæ*, with leaves radical or alternate, æstivation imbricate, petals 2-lipped, or with a scaly or foveate nectary attached, the carpels many, free, dry, indehiscent, 1-seeded, and the seeds erect.

(3781.) The *Helleboreæ* are herbaceous *Ranunculaceæ*, with radical or alternate leaves, imbricate æstivation, petals either absent or irregular, 2-lipped or nectariferous. The sepals petaloid, the carpels mostly definite, capsular, dehiscent, sometimes connate and many-seeded.

(3782.) The Ranunculaceæ are in general poisonous plants, as remarkable for the acridity of their juices and venomous properties as for the beauty of their flowers. The principle upon which their deleterious powers depends is, according to the observation of Krappen, of a very singular nature. It is so volatile, that in most cases simple drying or infusion in water, or decoction, is sufficient to remove it, and to render the plants innocuous; and in some it is developed in such small quantities as not to be injurious. It is said to be neither acid nor alkaline, but its activity is increased by the addition of acids, or the admixture of sugar, honey, wine, spirit, &c., and that it is only removed or effectually destroyed by the agency of water.

(3783.) *Clematideæ*. The Traveller's joy, the Virgin's bower, and other species of Clematis, are favorite ornamental climbing shrubs, with often fragrant flowers and mostly acrid juices. The leaves of *Clematis recta* and *flamula* are said when bruised to be employed by beggars to produce artificial ulcers, in order to excite commiseration and to extort alms. *C. erecta* was much recommended by Storck in obstinate cachectic diseases; and its powdered leaves have been used as an escharotic. Commerson says that in the Isle of France he saw the negroes raise vesications by applying the leaves of *C. Mauritania* to the cheek in order to relieve the toothach. To mark his sense of its acridity Commerson called it *C. furialis* and *urentissima*. *C. Vitalba* and *crispa* have both been used as rubefacients in the treatment of rheumatism; and the dried leaves of *C. Vitalba* form good fodder for cattle, notwithstanding they would poison the animals if they were eaten in a fresh state; hence affording a good example of the rule which predicates the volatile nature of their acrid principle.

(3784.) *Anemoneæ*. The *Thalictra* or meadow-rues, are bitter plants, with a fetid odor, and often cathartic roots. The root of *T. flavum* has been used to

dye wool of a yellow colour, and is said to have been serviceable, when taken in small doses, in removing jaundice. Cattle will eat it when mixed with grass, but it is too acrid to be eaten alone.

(3785.) The *Anemonies* are said to have been so named, from an old opinion that they never blossomed excepting when the wind blew; in fact, they do flower in the blustering seasons, and many love to grow in exposed and elevated situations.

The different species of *Anemone* are more or less acrid; some, as *A. patens, nemorosa,* and *pratensis,* extremely so: the former is used in Russia by the peasants to ulcerate their legs, in order to prevent their being forced into the army. *A. nemorosa* is poisonous to cattle, and *A. Pulsatilla* also very deleterious. An extract, prepared from it, has however been found serviceable in cutaneous affections, especially obstinate cases of tinea. The active principle of these plants is supposed to be a peculiar inflammable crystallizable body, which has been called *Anemonine.*

(3786.) The *Hepaticas* were once, on account of their 3-lobed leaves, supposed to have occult powers, and marvellous influence over diseases of the liver. They are now simply esteemed as ornamental garden plants. The leaves of *Knowltonia vesicatoria* are used in Southern Africa as epispastics.

(3787.) The yellow root of North America, which affords a beautiful yellow dye, is the *Hydrastis Canadensis.* It is also bitter, pungent, and somewhat tonic; and has been used medicinally.

(3788.) *Ranunculeæ.* Nearly 200 species of ranunculus are known, and these have been distributed into five or six sections or subgenera. The whole have pretty, and some very shewy, blossoms. They are remarkable for their general acridity. Some are violent poisons, such as *R.* (or *Thora*) *scutatus,* which was formerly employed by the Swiss hunters, to envenom their darts with which they shot the wild beasts; and others, such as *R. sceleratus* and *acris,* are scarcely less virulent: they excoriate the skin, and form ulcers that are difficult to heal; and even carrying specimens for a short time will occasionally inflame the hand. The distilled water of *R. Flammula* acts very speedily as an emetic.

The water crowfoot, *R. aquatilis,* is less acrid than any of the rest; and Dr. Pulteney extols it as a wholesome and nutritious fodder. In some parts of the country, as near Kingswood, on the banks of the Avon, the cottagers support their cows, and even their horses, almost wholly on this plant; and in wet situations, where it abounds, it would become, were its properties generally known, of considerable economical importance. Cattle will also eat the *R. arvensis* with avidity, but it is a dangerous food; and its juice is so poisonous, that M. Bruynon says 3 oz. killed a dog in four minutes; and sheep have been poisoned by feeding on it near Turin. The vulgar opinion, that the butter in spring owes its deeper colour and richness to the Ranunculi, hence called butter-cups, is an error scarcely worthy of contradiction, for they are plants that the cattle rarely touch.

(3789.) *Ficaria Ranunculoides* (olim *Ranunculus Ficaria*), is reputed to be a valuable astringent, and its roots have been used when bruised as a topical application to hæmorrhoids. It probably, however, owes its reputation more to the form of its roots than to their sanative effects. *F.* or *R. Glacialis* is said to be a powerful sudorific.

(3790.) *Helleboreæ.* The *Calthæ* and *Trollii* are shewy flowers, but their

herbage is acrid, and not esculent. The unexpanded buds of *C. palustris* have however been pickled as a substitute for capers, and the juice of the petals, when mixed with alum, affords a yellow dye, with which paper may be stained.

(3791.) The hellebores are violent drastic purgatives, and, in large doses, poisons. One species, *H. niger*, the *Melampodium* of the older writers, was formerly much in repute as a medicine, but its action is so violent, as well as that of *H. fœtidus*, and *H. orientalis*, which have likewise been used medicinally, that they are almost wholly laid aside; and it appears with reason, for death has not unfrequently followed their administration as anthelmintics. (Vide Med. Bot. xi. xxi. lxxxvii.) The latter species is now supposed to be the true ἐλλεβορος μελας of the Greeks; it grows plentifully on Mount Athos, at Delphi, and on the Bithynian Olympus. Anticyra, now Asprospizzia, a city of Phocis, was noted by the ancients for the hellebore it produced; and hence arose the proverb "Naviget Anticyram," as it was chiefly administered to the insane. It was likewise considered serviceable in cases of *Hypochondriasis*, *Melancholia*, *Hysteria*, &c.; and hence Horace, who, like some modern satirists, seems to have considered covetousness a mental disorder, a kind of madness, says,

> "Danda est ellebori multo pars maxima avaris;
> Nescio an Anticyram ratio illis destinet omnem."
> Sat. iii. lib. 2.

(3792.) *Coptis trifolia*, the old *Helleborus trifolius*, is a native of Iceland, Greenland, and the northern parts of Europe and America. The leaves and stalks have been used to dye skins and wool of a yellow colour; and a decoction of the root is said to form a good wash for aphthous eruptions of the mouth and fauces.

(3793.) The *Aquilegiæ*, or columbines, are curious and ornamental plants. They have received their names from the bird-like figure of their petals, which, when the flowers are inverted, have been fancied by some persons to be like young eagles, and by others to resemble a nest of doves. *A. vulgaris* has been used medicinally as an astringent and detergent, but it belongs to a suspicious group; and Linneus affirms that children to whom it has been administered have lost their lives by an overdose.

(3794.) The *Delphinia*, or larkspurs, have handsome irregular flowers, in some measure resembling the fanciful figures of dolphins or the spurs of larks; and hence, as in the preceding instance, their names have been derived. The leaves and stalks of the *Delphinia* are acrid, and the seeds poisonous. Those of the *D. Consolida* are said to enter into the composition of certain cosmetics, which, although primarily efficient, are found, by continued use, to be very destructive to the skin. A tincture of the seeds, in doses of twenty to thirty drops, is said to be serviceable in asthma; it produces a slight degree of nausea, but in overdoses is injurious. *D. Staphisagria* has also been used in the treatment of cutaneous eruptions; and formerly it was administered internally; but it is a dangerous drastic cathartic, and its use is now chiefly confined to hospitals and poorhouses, where the powdered seeds, sprinkled among the bedclothes, are found to be very effectual in destroying vermin. The active properties of the *Delphinia* seem to depend upon a peculiar alkaloid, which has been called *Delphine*.

(3795.) The Aconites are among the most powerful vegetable poisons known, and the ancients, who were unacquainted with chemical agents, regarded them as the most virulent in existence. Even the effluvia rising from the flowers have occasioned swooning fits, and caused blindness that has lasted for several days. Some cases are on record, in the Philosophical Transactions, and in the works of Turner and Willis, in which persons have been killed by eating the young shoots of monkshood in mistake for celery : and in Willis's case death was preceded by mania. (Vide Med. Bot. xxviii.) The root is, however, the most virulent part of the plant; a single drachm has been known to cause death. Out of four criminals, two at Rome, and two at Prague, to whom the root was given by way of experiment, A.D. 1524 and 1561, two perished, and the other two with difficulty recovered. Dodonœus also mentions five persons having been killed by eating the root in mistake. The Aconite is one of the plants to which reference has already been made, as entering into that deadly draught which the barbarous policy of the law condemned the old men of Ceos to drink, when they became infirm, and were no longer serviceable to the state. It is also said to have been the principal ingredient in the poisonous cup which was mingled by Medea for Theseus.

(3796.) Aconite has, notwithstanding the terrors with which it has been invested, been introduced into medicine ; and, according to the reports of Baron Stoerck and others, it has proved very beneficial in many cases of scirrhus, nodes, scrofula, and even of palsy and exostosis. It appears that *A. Napellus*, the officinal species of the British dispensatories, is not the plant recommended by Stoerck, which is a variety of *A. paniculatum*, called by De Candolle, in remembrance of the Baron, the *A. Stoerckianum*. From the experiments of Brodie and others, it has been proved that Aconite belongs to that class of poisons which destroy life through their immediate influence on the nervous system, without being necessarily absorbed. That most virulent Indian poison called *Bikh* or *Bish*, or at least one kind of it, is believed to be a preparation of a tropical species of Aconite, perhaps the *A. ferox*, figured by Wallich, in his Plantæ Asiaticæ Rariores, and which the native Indians use to poison the water in the tanks, in order to impede the progress of a hostile army. An attempt of this kind was made on the lives of our forces during the Nipal war, at Hotoura, but it was discovered in time to save the soldiers. It is also used in India to poison spears, darts, and arrows. *A. Cammarum* and *A. Napellus* are the most venomous European species. Linneus says that horses eat the latter with impunity when it is dry, but that it destroys kine and goats, especially when they come to it fresh. He also tells us, that the *A. Lycoctonum*, a decoction of which is used to kill flies, is eaten as a vegetable in Medelpadia, a province of Sweden ; and it seems to be milder and less deleterious than most other species. The active principle of Aconite is supposed to be an alkaloid discovered by Pallas, and subsequently examined by Brandes, who called it *Aconitia*. It possesses the poisonous properties of the plant in a concentrated form.

(3797.) Along with the foregoing poisonous vegetables are found the *Nigellæ*, which, although acrid, are so in a less degree; and, from the aromatic principle, which is also present, the seeds of some, as *N. arvensis*, *N. Damascena*, and *N. sativa*, have been used as carminative medicines, and even as spices in cookery. They are also often employed to adulterate pepper. In France the *fennel-flower* is even called *poivrette:* and in some parts of Germany, and in Asia, its leaves, as well as seeds, are esteemed as condiments.

(3798.) PÆONIACEÆ. *Pæonia*, and its allies, sometimes called "spurious Ranunculaceæ," seem rather to form a group intermediate between the *Ranunculaceæ* and *Nymphæaceæ*, than to be a spurious adjunct of the former; and this transitional affinity will be still more evident, if the propriety of their union with the *Cabombidæ* be acknowledged, a union suggested by De Candolle, and on his suggestion established here.

(3799.) The *Pæoniaceæ*, including the two subtypes *Pæonidæ* and *Cabombidæ*, are, collectively considered, perennial herbaceous plants, rarely becoming suffrutescent, with radical or alternate, rarely opposite leaves, destitute of stipules, but with dilated petioles in the first subtype, and simple unexpanded ones in the second. The inflorescence is axillary or terminal, in general solitary, regular, and united.

The calyx is free, formed of 3-5 sepals, deciduous or persistent, often coloured within, and imbricate in æstivation. The petals are exserted alternately with the sepals, and disposed in a single series, or in double or triple rows. The torus is more or less developed, but never investing the ovaries: the stamens are hypogynous, definite, or indefinite; when the former, they are equal to the petals in number, or some multiple thereof. The filaments are free, and often filiform; the anthers terminal and introrse, 2-celled, and mostly elongated, and dehiscent longitudinally by chinks; sometimes subglobose, and bursting transversely. The germen is formed of two or several carpels, rarely by abortion reduced to one, the ovules several or many, the styles short or none, and the stigmata thickened, and sometimes subpeltate.

The fruit is succulent or capsular, formed of 1 or more carpels, indehiscent, or more rarely dehiscent, either lengthwise or transversely. Each carpel is 1-celled, the seeds definite or indefinite, pendulous and exarillate, rarely with a small arillus. The albumen is fleshy, the embryo small, straight, or fungilliform, and situated at the base of the seed, with the radicle near the hilum.

(3800.) Hence, differentially considered, the *Pæoniaceæ* are herbaceous *Ranunculianæ*, with exstipulate leaves, introrse anthers, and albuminous, mostly exarillate seeds, with the embryo lodged in the albumen.

(3801.) The subtype *Pæonidæ* includes those terrestrial genera in which the leaves are deeply cleft, and the petioles sheathing;

(3802.) While, in the subtype *Cabombidæ*, the leaves are broad and lobed, in the aquatic species floating, and the petioles not amplexicaul.

(3803.) The *Pæoniaceæ* are in general acrid, but less noxious plants than the *Ranunculaceæ;* and, although some are deleterious, they are for the most part rather medicinal than poisonous vegetables.

(3804.) *PÆONIDÆ.* The *Pæonies* derive their name from Pæon, by whom they were first medicinally employed; and it was with them, according to Homer (Od. v.), that he cured Pluto of a wound inflicted by Hercules. By the ancient Greek physicians the Pæony was held in very high esteem, but their praises are too extravagant for sober repetition. Among other superstitions, they believed it to be of divine origin, an emanation from the moon, and that it shone during the night; also that it had the power of driving away evil spirits, averting tempests, and protecting harvests from injury: superstitions which probably sprang from each other, and gave rise to the long train of errors above adverted to; as Murray says, in his singular illustration, "*Unus error ex altero, ut articuli in tænia, pullulat.*" Modern times are not, however, free from some remnants of these absurdities. The anodyne necklaces, still sold to prevent convulsions in

children and to ease dentition, are made of beads turned from the root of the common pæony. Its antispasmodic powers, though often dwelt on, are very feeble, and it is chiefly to be regarded as a nauseous and acrid bitter. The seeds of *P. officinalis* are said to be emetic and cathartic, and the roots of *P. anomala* and *P. albiflora* are, according to Pallas, eaten in Siberia, either simply boiled, or as an ingredient in soups. The seeds of the latter are also, he says, used in the same country instead of tea.

The Pæonies, however, are chiefly cultivated for the beauty of their flowers; and in China the Moutan is as great a favorite as the rose is here. The Chinese poets have celebrated it in verse, and their gardeners claim the honour of having rendered it suffrutescent by skill and care. The several varieties of *Moutan* are much less tender than they are usually considered, and will flourish in our gardens with very slight protection.

(3805.) *Cimicifuga fetida*, the common bug-bane, is a very offensive herb, used in many countries as tansy is with us, for the purpose of driving away vermin. *C. serpentaria* is reported by the native practitioners, in North America, to be serviceable in the treatment of the dangerous bites of the rattlesnake.

(3806.) The *Actææ*, or bane-berries, bear poisonous fruits, but their roots are said to be valuable for their antispasmodic and expectorant properties. They are also astringent, and are reported to afford very marked relief in cases of catarrh.

(3807.) The wood and bark of *Xanthorhiza apiifolia*, the yellow root of North America, are very bitter: they are esteemed as a tonic medicine, but are somewhat acrid.

(3808.) *Cabombidæ.* Small as is this type, the four or five genera, including at the most five or six known species, which are all it comprehends, have been distinguished into two subordinate groups or districts, called the *Podophylleæ* and *Hydropeltideæ*.

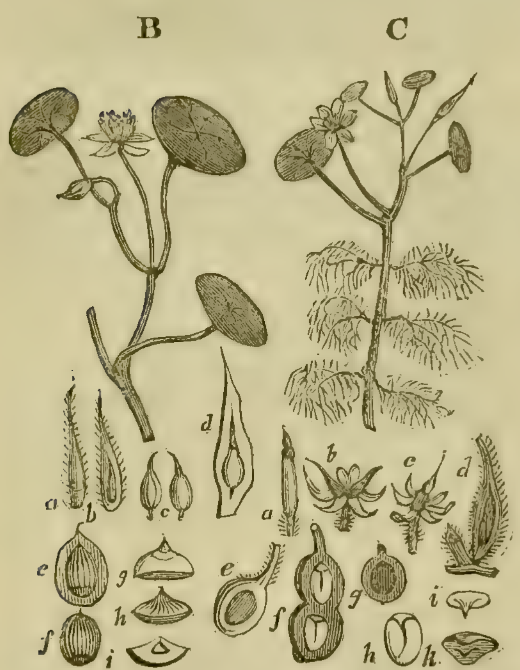
(3809.) The *Podophylleæ* are erect non-aquatic herbs, with stamina twice as many as the petals. The ovary single, the stigma thick and subpeltate, and the seeds indefinite.

(3810.) The *Hydropeltideæ*, on the contrary, are aquatic herbs with floating leaves, ovaries 2 or many, and the seeds few, or by abortion solitary.

(3811.) *Podophyllum* and *Jeffersonia*, (with perhaps Achlys,) which form the first named district, are North American plants, growing in damp shady places. Their roots are said to be cathartic, their herbage narcotic and poisonous, and their fruit eatable, but sour, and far from pleasant. *Podophyllum peltatum* is the *wild lemon*, or May-apple, of the colonists; and its root, whether in decoction or powder, is a valuable aperient, being one of the most safe, easy, and certain known. An extract has also been prepared, the action of which is much commended.

(3812.) Of the properties of *Cabomba* and *Hydropeltis*, which together form the other district, there is nothing certain known. They are chiefly interesting as forming the transition from this subsection to the next: Hydropeltis is intimately connected with *Caltha*, and *Cabomba* bears a great similitude to the Batrachia, even in its heteromorphous foliage, the floating leaves being lobed, while the immersed ones are very much divided. De Candolle mentions their close affinity to the *Nymphæaceæ*, with which they are associated by Bartling; but, although the relationship is acknowledged, their non-vitellose seeds exclude them from the next subsection, although they are justly placed on the confines of

it. *Cabomba* is said by Richard to be a monocotyledon; but this assertion appears to be erroneous.



B. *Hydropeltis purpurea.*
(*a*) One pistil separated.
(*b*) Ditto cut lengthwise, to shew the ovules.
(*c*) Carpels in different stages of development.
(*d*) Section of a carpel, to shew the abortive and the fertile ovule.
(*e*) A seed, with part of the testa removed.
(*f*) The nucleus.
(*g*) Section, to shew the embryo.
(*h*) The embryo isolated.
(*i*) Section of the same.

C. *Cabomba aquatica.*
(*a*) A flower-bud.
(*b*) Calyx and carpels.
(*c*) Calyx, with one fertile carpel, the others abortive.
(*d*) Sections of pistil, to shew the ovules.
(*e*) Section of fruit, to shew the solitary seed.
(*f*) Ditto with 2 seeds.
(*g*) A seed with part of the testa removed.
(*h*) Section of the nucleus.
(*i*) Embryo.
(*k*) Section of ditto.

NELUMBIANÆ.

(3813.) *Nelumbium* and *Nymphæa* are the normal genera of the two types called, from them, *Nelumbiaceæ* and *Nymphæaceæ*, which are included in this subsection. These genera, although essentially distinct, are in many particulars so much alike, that they were formerly considered but species of one and the same genus; their affinity with the *Cabombidæ* has been already dwelt on, and their relationship to the poppy tribes is no less striking.

(3814.) Collectively considered, the *Nelumbianæ* are aquatic *Ranunculinæ* with prostrate stems, peltate or cordate floating fleshy leaves, sepals, petals, and stamens passing into each other, embryo excluded or without the albumen, but enclosed in a membranous sac, which is the persistent vitellus.

(3815.) NELUMBIACEÆ. *Nelumbium* is the only genus included in this type; and its several species, not amounting to more than 5 or 6, of which only 2 or 3 are well known, are aquatic herbs, with peltate fleshy leaves, rising from a rhizoma or prostrate stem; the petioles are long, not sheathing, and the stipules are absent. The inflorescence is solitary, the peduncles long, varying in length with the depth of the water, round and ebracteate. The flowers are large and shewy, regular, and united.

The sepals 4-5, petals many, oblong, and multiseriate, exserted from without the base of the disk. The stamens are indefinite, arising within the petals in several series. The filaments are petaloid, and the anthers adnate, and dehiscent introrsely by a double longitudinal cleft. The disk is obconical, truncate, fleshy, elevated, and greatly developed, forming many cells, in which the ovaria, which are numerous and discrete, are lodged. The germen is 1-celled and 2-ovuled, the style is single, and the stigma simple.

The fruit consists of numerous nuts, half-immersed in cavities of the fleshy disk, and separated by sinuous dissepiments. The nuts are 1-celled, 1-or rarely 2-seeded; the seeds exalbuminous, the embryo large, and furnished with 2-fleshy cotyledons; the plumula highly developed, and inclosed in its persistent vitellus, which forms a peculiar membranous sac.

(3816.) Hence, differentially considered, the *Nelumbiaceæ* are vitellose *Ranunculinæ* or *Nelumbianæ*, with discrete, simple carpels, imbedded in a fleshy foveolate torus, exalbuminous seeds, and a large embryo.

(3817.) The *Pythagorean bean* is supposed to have been the fruit of *Nelumbium speciosum*, or the water *Lotus*, formerly a native of Egypt, and other warm regions, in Africa and Asia, but now not to be found in the Nile, its most celebrated habitat of antiquity. It was called *Cyamus* by the ancients, and its present generic name is an alteration of the Cingalese word *Nelumbo*.

The rhizoma, commonly called the creeping root, as well as the seeds, are eatable, and they are said to be both savory and wholesome. In China the plant is called *Lien-wha*, and the seeds and slices of the scaly rhizoma, with the kernels of apricots and walnuts, alternated with layers of ice, were frequently presented to the British ambassador and his suite, at breakfasts given by some of the principal mandarins. The root-stakes are preserved by the Chinese in salt and vinegar for winter use. In Persia, Japan, and many other countries, it is much esteemed as food, and its seeds made into bread. In China and Japan it is regarded as a sacred plant, considered to be a pleasing offering to their deities, and their idols are often figured sitting on its leaves. *N. luteum*, which is a native of America, has been naturalized in the ponds as far north as Philadelphia, and its fruit is much relished by the Indians and by children.

(3818.) Nymphæaceæ. *Nymphæa*, *Nuphar*, *Barclaya*, and *Euryale*, which together form this small type, are, like the *Nelumbiaceæ*, their immediate allies, aquatic perennial herbs, with prostrate stems or rhizomata, from which arise peltate or cordate fleshy leaves, supported on long petioles, destitute of stipules, and non-vaginant. The inflorescence is solitary, axillary, or supra-axillary; the peduncles long and ebracteate, and the flowers regular and united.

The sepals and petals are numerous, and pass so gradually into each other that the limits of calyx and corolla are indefinable; they are exserted from the disk, that surrounds the pistil, and are imbricate in æstivation. The stamens are many and multiseriate, exserted from the disk within and above the petals, and sometimes forming, with the coherent petals, a superior spurious monopetalous corolla. The filaments are flat, often petaloid, and frequently produced beyond the cells of the anthers. The anthers are adnate, and burst introrsely by a double longitudinal cleft. The disk is large and fleshy, and girds the ovarium more or less closely. The germen is formed of many connate carpels, is many-celled and many-ovuled,

with sessile stigmata, which are connate, and form a radiating crown to the germen. The fruit is capsular or subbaccate, many-celled, many-seeded, and indehiscent. The dissepiments are membranaceous, and covered with broad spongy placentæ; the seeds are numerous, attached to the expanded placentæ, and in-

A

A. *Nymphæa alba.*

(*a*) Flower, with the petals and most of the stamens removed, to shew the pistil and its radiated stigma.

(*b*) The fruit.

(*c*) Transverse section.

d (*e*) Seeds.

(*f*) Embryo within the vitellus.

(*g*) Section of the vitellus, to shew the embryo.

(*h*) A seed cut lengthwise to shew the embryo.

vested with a subgelatinous arillus. The albumen is mealy, the embryo small, outside of the albumen, but included in the persistent vitellus. The radicle is turbinate, and the cotyledons foliaceous.

(3819.) Hence, differentially considered, the *Nymphæaceæ* are vitellose *Ranunculinæ* or *Nelumbianæ*, with concrete carpels, a many-celled, many-seeded fruit. The seeds albuminous, and the embryo small.

(3820.) The *Nymphæaceæ* are astringent, bitter, and innocuous plants. They are also reputed to possess sedative and aphrodisiac powers; but these latter are far from having been satisfactorily established. Their rhizomata contain much farinaceous matter; and, when the bitter principle has been removed by repeated washings, their creeping stems are esculent, such especially as those of *N. edulis* and *rubra*. The seeds of *N. rubra* and *N. Lotus* are also eatable. The stems of *N. odorata* contain a large proportion of tannin and gallic acid, and will strike a deep black with the salts of iron: and those of *N. alba* are also used to dye a dark chesnut brown; both have been occasionally employed medicinally as astringents, but their use is almost obsolete, being seldom resorted to as styptics, and only occasionally chewed by singers to relieve relaxation of the uvula and soft palate, give firmness to the vocal organs, and clear the voice. Swine will feed upon the water lilies, both *N. alba* and *Nuphar lutea;* and goats will also eat them; but they are not fed upon by kine, horses, or sheep. The root-stakes of the latter, which

is the common yellow water-lily, are said to be destructive to beetles and cock-roaches, when bruised and infused in milk: they are also sometimes burned, to get rid of crickets, to which the smoke is said to be peculiarly obnoxious.

(3821.) The *Nymphæaceæ* are highly ornamental aquatics, and the flowers of some are very fragrant. Others are scentless; and those of *Nuphar lutea* have an alkoholic odor resembling brandy. They are also physiologically interesting, from the varied elongations of their peduncles, to suit the varied depths of the waters in which they grow, and their almost sensitive irritability, which causes their daily elevation above the surface of the water, and the expansion of their petals during the sunshine, and the nocturnal collapse of the flowers, with their drooping heads, which in some instances lie down on the shield-like leaves, and in others retire below the surface of the water during the night, but again emerge on the coming of day.

(3822.) The rhizomata of *Euryale ferox*, like those of its allies, are eatable.

(3823.) The affinities of the *Nelumbianæ* have been much disputed. Richard and others once believed them to be monocotyledons; and they do bear no slight resemblance to the Hydrocharides, which were the Nymphææ minores of the older botanists: but their foliage, and the structure of their stems, decide them to be exogenous plants; and the investigations of De Candolle, and others, have shewn that their seeds are dicotyledonous also. In habit they resemble many of the *Ranunculaceæ*, and in their lactescence and shewy flowers they are very similar to some of the poppy tribes in the following section: as well as to the *Magnoliaceæ* and *Pæoniaceæ*, especially the *Cabombidæ*. Indeed, as Don observes, this very natural group is intermediate between the *Ranunculaceæ* and *Papaveraceæ*, and is therefore transitional from the present to the following section.

RHÆADINÆ.

(3824.) Eight types of very varied extent are included in this section; and, as the *Rhæadeæ* of Linneus is the normal group, they may be termed collectively the *Rhæadinæ*.

(3825.) Differentially considered, the *Rhæadinæ* are hypogynous *Rosales*, or *Rhæadosæ*, with a symmetrical free germen, formed of several concrete carpels, connate and often persistent styles, and intervalvular placentæ, for the most part parietal.

(3826.) *Sarracennia*, *Papaver*, *Fumaria*, *Brassica*, *Capparis*, *Reseda*, *Polygala*, and *Tremandra*, are the normal genera of the eight included types, which, from them, have been denominated the *Sarracenniaceæ*, *Papaveraceæ*, *Fumariaceæ*, *Brassicaceæ*, *Capparidaceæ*, *Resedaceæ*, *Polygalaceæ*, and *Tremandraceæ*. This series of natural groups extends from the confines of the *Ranunculinæ*, with which the first type is closely connected, to the borders of the *Rutinæ* and *Acerinæ*, with the *Pittosporaceæ*, of which the *Polygalaceæ* have many characters in common.

(3827.) Sarracenniaceæ. The *Side-saddle flowers*, or *Sarracenniæ*, so named in remembrance of Dr. Sarrazin, who first sent specimens of these plants to Tournefort from Canada, are all referred to a single genus, which stands alone in the present type; a type which, in its concrete carpels and multilocular fruit, agrees with the *Nymphæaceæ*, and in its dilated foliaceous radiant stigmata with the

Papaveraceæ, near which latter it is usually arranged. Lindley dwells on its ascidiate leaves as indicating an affinity with *Dionæa* and Drosera, the expanded petioles of the former of which may be considered one stage of such a development;

Sarracennia purpurea.

c. Entire plant.

(*a*) Pistil separate, to shew the free germen and peltate stigmata.

(*b*) Transverse section of the fruit.

(*c*) Fruit dehiscing by valves.

(*d*) Portion of fruit, to shew the numerous seeds.

(*e*) A single seed detached.

(*f*) Section of ditto.

but, as even when *ascidia* are fully formed, as in *Nepenthes* and *Cephalotus*, no immediate relationship is admitted to exist, such a connexion can scarcely be supposed to be established by them in a rudimentary condition. (Vide § 3242.)

(3828.) The *Sarracenniæ* are herbaceous perennial plants, inhabiting swamps, with fibrous roots, radical leaves, some of the leafstalks being hollow or ascidiform, with the plane of the leaf forming a lid, and articulated at its union with the dilated petiole. The superior axis is abortive, and the flowers are solitary on scapes, the whole of the envelopes are of an herbaceous colour, regular, and the stamens and pistils monothalamous or united.

The calyx is formed of five persistent sepals, concave at the base, imbricate in æstivation, surrounded by a tri-bracteate involucrum. The corolla consists of five petals, contracted at the base and unguiculate. The stamens are hypogynous in their exsertion, indefinite and crowded; the filaments are shortish, the anthers oblong, adnate, 2-celled and dehiscent introrsely by longitudinal clefts from the base nearly to the apex. The germen is superior, globose, with five longitudinal furrows; it is formed of five concrete carpels, the cells are five, and the placentæ axial and many-ovuled. The style is columnar, the stigmata foliaceous, much dilated, peltate, and pentagonal.

The fruit is a globose capsule, crowned by the persistent peltate stigmata; 5-lobed, 5-valved, 5-celled. The dehiscence is loculicidal, the valves opening from the apex and bearing the dissepiments. The seeds are indefinite, small, minutely verrucate and crowded on the five large intervalvular placentæ, which

project from the axis into the cavity of the cells. The albumen is waxy and granulate, and very copious; the embryo cylindrical and cleft, so as to shew its two cotyledons, and situated near the base of the seed, with the radicle turned towards the hilum.

(3829.) Hence, differentially considered, the *Sarracenniaceæ* are ascidiate scapescent *Rhœadosæ*, with indefinite discrete stamens, concrete carpels, axial projecting intervalvular placentæ, indefinite albuminous seeds, and peltate foliaceous stigmata.

(3830.) The several species of Sarracennia already known, which do not exceed six, with two or three varieties, are all natives of the bogs and swamps of North America. Of their properties there is nothing decidedly ascertained, and they are chiefly interesting from bearing the curious pitcher-like organs already described, which contain water, to which, in dry weather, it is affirmed, birds and other animals resort to assuage their thirst. The lids are said to close over the mouths of the urns in dry weather, to prevent the evaporation of the water, which is probably designed to furnish the plant with supplies when the marshes are exhausted. These pitchers also contain large numbers of dead flies and other insects, which, when putrefying, give out an intolerable odor, that renders the plants offensive; but the decomposition of the animal matter affords a supply of rich and very nutritious food, probably essential to the well-being of the Sarraceniæ, as they are furnished with such curious organs to entrap and retain it—organs which have been supposed to be amongst the earliest adumbrations of a stomach.

(3831.) PAPAVERACEÆ. The Poppies, and their typical allies, are annual or perennial herbs (rarely undershrubs), with lactescent juices, varying in colour from

Papaver somniferum.

c. Cutting, with leaves and flowers.

(*a*) Capsule, with persistent radiant stigmata.

(*b*) Transverse section of ditto in a young state.

(*c*) A seed.

(*d*) Section of ditto, to shew the albumen and small embryo.

(*e*) The embryo enlarged.

white to yellow, orange, reddish brown, and crimson. The roots are in general fibrous, and the stems round, with imperfect nodes, the leaves are alternate and

simple, either stalked or sessile, and the lamina is often continuous with the stem, but destitute of stipules. The inflorescence is ~~solitary~~, the peduncles long, the flowers regular and united, variable in colour, but never blue.

The calyx is formed of 2 sepals, which are caducous; the petals 4 or some multiple of that number, and set crossways, in two or three series, equal and regular in form, and corrugate and imbricate in æstivation: (in Hypecoum the inner petals are 3-lobed, and in Bocconia the corolla is abortive.) The stamens are 8 or some multiple of 4, (rarely definite,) commonly indefinite and collected into four groups, one near the base of each petal, and hypogynous in their exsertion sometimes, as in *Eschscholtzia*, apparently perigynous by the excavation of the peduncle; the filaments are filiform and free, the anthers innate and 2-celled, dehiscing by longitudinal clefts. The germen is free, symmetrical, formed of 2 or more concrete carpels, sometimes stipitate, at others sessile, and invested by a membranous production of the thalamus; in general 1-celled, and the placentæ parietal and many-ovuled. The style is short or absent, and the stigmata, 2-4 or many, are radiant and persistent.

The fruit is a 1-celled capsule, with parietal intervalvular placentæ; 2 or many in number, according to the number of carpels of which the fruit is formed. The capsules dehisce either by valves or pores. The seeds are numerous, and exarillate in all except *Boceonia,* which has a solitary seed invested by an arillus. The albumen is oily and fleshy. The embryo minute and straight, situated at the base of the albumen, with the radicle near the hilum, and the cotyledons plano-convex, entire, linear oblong, and foliaceous during germination.

(3832.) Hence, selecting the chief differential characters, the *Papaveraceæ* are lactescent *Rhœadinæ,* with cauline alternate leaves, 2 sepals, petals when present 4 and equal, stamina free, ovary 1-celled, and the seeds albuminous.

(3833.) The thirteen genera included in this type form a very natural group; the only exceptions to the general rule worth notice being the apparently perigynous exsertion of the stamens in *Eschscholtzia,* the 3-lobed inner petals of *Hypecoum,* and the apetalous flowers and 1-seeded fruit of *Bocconia.* In properties likewise they are as accordant as in form, being almost universally narcotic, although they differ in the degree in which the sedative principle is evolved.

(3834.) The poppies are, many of them, very shewy ornamental plants, but their chief importance results from the narcotic powers of their milky juices. They are all more or less soporific, but the inspissated secretions of Papaver somniferum, and its varieties, are believed to afford our chief supplies of opium, although it has been asserted that the best Turkey opium is procured from the *P. orientale*: and other species are believed to be resorted to for the preparation of the drug in Persia, and other oriental countries. That the *P. somniferum,* however, yields it in abundance, has been proved by crops grown in this country, and the preparation here of English opium; which is reported to have been equal in all respects to that imported from India or the Levant, indeed, to yield a larger quantity of morphia than that of foreign growth.

(3835.) The opium trade is one of very considerable importance. In 1829 nearly 50,000 lbs. were imported into this country, of which 42,804 lbs. came directly from Turkey; 25,000 lbs. were re-exported; so that the annual consumption in the United Kingdoms varies from about 20 to 25,000 lbs. Its value in bond is 17*s.* or 18*s.* per lb., and the duty 4*s.* In England opium is little used excepting as a medicine; but in Turkey and in China it has escaped from the physicians' con-

trol, and is used largely as a luxurious stimulant, and as a substitute for spirituous liquors to produce intoxication. The importation of opium into China is expressly forbidden by law, not however on commercial or political, but on moral grounds; but, as this drug is as necessary to a Chinese mandarin as claret or burgundy to an English gentleman, the contraband trade is very extensive, amounting to 14,000,000 Spanish dollars yearly, and from it alone our Indian government derives an annual revenue of 1,800,000*l.* sterling.

(3836.) Without reference to the numerous fraudulent adulterations, opium is a very heterogeneous compound, consisting of at least a dozen proximate principles; of these the most important are two peculiar alkaloids, called morphia and codeine, on which its sedative powers depend; *narcotine*, which is stimulant as well as narcotic; *meconic acid*, and *narcine:* besides various resinous and oily matters, for a full account of which see Pelletier's Essay, or *Med. Bot.* clix.

(3837.) Some extraordinary cases are on record of the effects produced by the continued use of opium, the ecstasies it occasions, and the deplorable condition to which it in a short time reduces the infatuated men who eat it. The Turks call *opium* MASCH-ALLAH, which signifies literally the work of God, and they take it in graduated doses of from 10 to 100 grains daily; in general it is mixed with some rich syrups to render it palatable. Some travellers however affirm that the Turkish Masch-allah is a compound, containing hemp and other narcotics, as well as opium. Even in England the baneful custom of opium-eating has increased lately to a little-thought-of extent. Several cases have come to my knowledge, in which both laudanum and solid opium have been taken daily in enormous quantities; and others have been recorded, on unquestionable authority, in which as much as half a pint to a pint and upwards of the former, and from half a drachm to a drachm of the latter have been consumed daily, until it became not merely a luxurious indulgence, but an absolute necessary of life; the persons being utterly miserable, and apparently half dead, until they had swallowed as much as would have poisoned some half-dozen healthy men. Debility, and destruction of both mental and bodily powers, are the general sequelæ of this indulgence; but occasionally, as appears from the reports collected and published by Christison, life does not appear to have been shortened, nor disease produced.

(3838.) Although the juices of the poppy are powerfully soporific, this property is absent from its seeds, which are very numerous, each capsule containing on an average about 32,000. These seeds have a nutty flavour, and form a very nutritious food. They abound with a bland oil, which, when expressed, may be used as a substitute for olive oil in culinary and other processes; and the marc that remains forms good fodder for cattle, and also may be given to poultry. The seeds of the other poppies are also oleaginous; and in Poland, and some parts of Russia, those of *R. Rhœas* are used as an ingredient in soups, and to make gruels and various kinds of porridge. This last named species, which is the corn-poppy of England, is here chiefly employed to form a red syrup, the petals being the parts collected. This, as well as *P. Argemone*, are but very slightly narcotic, and their foliage has been used as a potherb.

(3839.) *Meconopsis Cambrica* is our yellow Welsh poppy; it is an innocuous plant: but an Indian species, *M. Nipalensis*, is said to be very poisonous, especially its roots.

(3840.) *Argemone Mexicana* is the *figo del inferno*, or devil's fig, of Mexico.

It is a prickly plant with yellow acrid juices, which are sometimes used as epispastics; they are also dropped into the eye by the Indian practitioners to cure ophthalmia; and hence the generic name. The seeds are said to be purgative and emetic, and the oil with which they abound, when expressed, has been affirmed to be nearly as active as that of the *Croton Tiglium*. This statement, however, requires confirmation. Its most general use is for the purposes of illumination.

(3841.) *Sanguinaria Canadensis* is the *Puccoon*, or *Canadian blood-root*, so called from the sanguineous colour of its juices. It is an acrid narcotic, and has been used as a sternutory and escharotic for the removal of nasal polypi. It is also said, in graduated doses, to have been serviceable in hooping-cough, and likewise in the incipient stages of pulmonary consumption. This plant has been used as a yellow dye, and by the American farriers it is called *turmeric*.

(3842.) The Celandines, or swallow-worts, have orange-coloured acrid juices, which have been used as detergents, and to destroy vermin, especially that kind which infests foul ulcers in horses. An infusion of the root has been administered for the cure of jaundice, probably from its yellow colour, as scarlet clothes were once thought good for fevers. Both roots and stems have been used as dye stuffs.

(3843.) Fumariaceæ. The plants associated by their general similitude to Fumaria, to form this type, are non-lactescent herbs, with sometimes tuberous roots, and brittle glabrous stems. The leaves are usually alternate, compound, often cirrhose, and destitute of stipules.

The inflorescence is racemose, the pedicels furnished with bracteæ, and the flowers irregular and united. The calyx is free, small and membranaceous, and formed of 2 sepals, which are deciduous. The torus is obsolete. The petals are 4, set crosswise, deciduous, either discrete or coalescent by their ungues, the 2 external ones alternate with the sepals, and either 1 or both saccate at the base; the two inner ones alternate with the outer, subcallous at their apices, where they are coloured by a terminal spot, and connected so as to enclose the anthers and stigma: there are nectariferous glands within the spurs, and the two calcarate petals are by some physiologists considered sepals, and the two leaves above described as sepals bracteæ; so that, according to this latter view, the parts of the flower have a binary development. The stamens are six in number, the filaments diadelphous, (rarely free,) united into two bundles, which alternate with the two inner petals, and are therefore opposite the outer ones. The anthers are six; the lateral in each fascicle being 1-celled, while the central ones are each 2-celled. They are small, erect, and dehisce longitudinally by chinks. The germen is formed of 2 connate carpels, the style filiform, and the stigma bilamellate, and parallel with the internal petals.

The fruit is 1-celled, dry, and capsular, but various in form, sometimes being an indehiscent 1-2 seeded nut-like pod, and at others a 2-valved dehiscent polyspermous ceratium. The seeds horizontal and fixed to narrow lateral placentæ, black, shining, and furnished with caruncles or an arillus. The albumen is fleshy, the embryo small, basilar, and extra-axile; in the indehiscent fruits straight, in the dehiscent ones slightly arched; the radicle near the hilum, and the cotyledons flat, oblong, entire, and foliaceous in germination.

(3844.) Hence, differentially considered, the *Fumariaceæ* are non-lactescent *Rhœadinæ* with a disepalous calyx, an irregular 4-petaled corolla, definite hypo-

gynous stamens, in general diadelphous; concrete carpella and narrow parietal placentæ, with albuminous, arillate, black and shining seeds.

(3845.) The economy of the floral organs of these plants is still a matter of question, their 4 petals being, as already observed, sometimes regarded as both calyx and corolla, each formed of only 2 pieces, and the outer 2 leaves considered as bracteæ; and this view the position of the stamens would seem to countenance. By their deciduous 2-leaved calyx, and 4-petaled corolla, they are associated with the *Papaveraceæ*, from which however they are distinguished by the connate filaments and watery sap, as well as by their mostly irregular flowers. Their affinity with the *Brassicaceæ* or *Cruciferæ* is also obvious, of which the number of their stamens and the disposition of their petals are proofs; but they differ from them particularly in their disepalous calyx and albuminous seeds. Their flowers also are purple, yellow, or white, emulating, as De Candolle observes, those of the Polygalaceæ.

(3846.) The *Fumariaceæ* are innocuous plants; they are inodorous, their herbage is bitter, and has been esteemed slightly diaphoretic and aperient; and their watery juices were formerly administered in cutaneous diseases and obstructions of the hepatic system. *F. officinalis* is the *Fumus terræ* of the older herbalists, so called from the light and smoke-like cloudiness of its foliage; whence the modern generic name, *Fumaria*. *Corydalis bulbosa*, which has grumous roots abounding in fecula, is resorted to by the Kalmucs in winter as food.

(3847.) Brassicaceæ or Cruciferæ. The Coleworts and their allies, which form a large and very natural group of plants, have, from their possessing cruciform corollæ, been commonly called *Cruciferæ*, or *Crossbearers;* but, as other

B. *Cheiranthus Cheiri.*

B. Cutting to shew leaves, flowers, and fruit.

(*a*) Flower with sepals, stamens and pistils, the petals being removed.

(*b*) The silique dehiscent, and shewing the replum and seeds.

(*c*) Transverse section of the fruit, to shew the replum and two cells.

(*d*) The embryo isolated.

plants, such especially as the *Papaveraceæ*, *Capparidaceæ*, and *Fumariaceæ*, included in this section, are also remarkable for a like cruciate dispositon of the

petals, BRASSICACEÆ, a derivative of *Brassica*, a well known normal genus, would seem to be a preferable name.

(3848.) The BRASSICACEÆ, or *Cruciferæ*, are herbaceous plants, rarely becoming suffrutescent, with round or irregularly angled stems and branches, and aqueous juices. The leaves are simple, often incised, but seldom truly compound, sessile or petiolate, the petioles non-amplexicaul, and the stipules wanting.

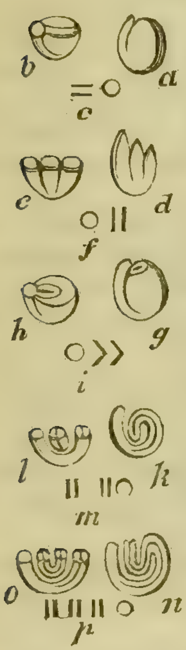
The inflorescence is usually in corymbiform racemes, seldom solitary, the racemes axillary, or by abortion sometimes apparently terminal, and usually with ebracteate pedicels. The flowers are united, for the most part regular, and in colour white or yellow, rarely red or purple. The perianth is double, and all its parts discrete. The calyx is free, formed of 4 sepals set crosswise, imbricate, (rarely, as in *Ricotia* and *Savignya*, the sepals are valvate in æstivation,) and in general deciduous. The exterior sepals, often the narrowest, are opposite to the placentæ; and the two interior ones, which are opposite the valves of the fruit, are frequently concave, gibbous, or calcarate at the base. The corolla is 4-petaled, the petals cruciate and exserted alternately with the sepals, in general with long ungues and equal laminæ, but sometimes irregular in size and occasionally abortive. The torus is small, sometimes supporting the germen; at others being furnished with nectariferous glands, situated between the petals, stamens, and germen. The stamens are six in number, rarely by abortion reduced to 4 or 2, and tetradynamous; the two which are opposite the lateral or valvular sepals are solitary, and shorter than the other two, which are situated in pairs opposite to the placentarial sepals. The filaments are free, or rarely subconnate, and dentate on their inner sides; the anthers are subincumbent, 2-celled, with parallel opposite locules, exappendiculate, introrse, and dehiscent longitudinally by chinks. The germen is formed of 2-4 connate carpels, with parietal placentæ, and mostly many ovules, 1-celled, or by a spurious dissepiment rendered bilocular. The style is short when the germen is long, and long when the germen is short. The stigmata are two, and opposite to the trophosperms.

The fruit is siliquose, rarely 1-celled and evalvate, in general 2-celled and 2-valved, the septum being formed by a dilatation of the placentæ, which is called a replum. It is dehiscent by valves, or sometimes transversely, or even occasionally indehiscent. The seeds, 1-2 or many, are in general pendulous, and fixed to both sides of the placentæ, which hence would seem to be double. They are exarillate and exalbuminous, with thickish subcoriaceous testæ. The embryo is curved and oily, the radicle round or subconical, and turned towards the hilum; and the cotyledons folded diversely on the radicle, and foliaceous in germination. When the embryo is so curved that the radicle is applied *to* the edges of both cotyledons, it is said to be accumbent, [vide § 3851. *a*, *b*, *c*.]; when folded *upon* the side of one, incumbent [§ 3851. *d*, *e*, *f*, *g*, *h*, *i*, &c.]

(3849.) Hence, selecting the chief differential characters, the BRASSICACEÆ are ebracteate cruciform *Rhœadinæ*, with tetradynamous stamens, trophosperms opposite the stigmata, and exalbuminous seeds.

(3850.) The numerous genera included in this type have been very variously arranged. De Candolle distributes them into six primary groups or subtypes, several of which are again divisible into minor districts. The characters of the subtypes are founded upon the number and diverse folding of the cotyledons; the districts chiefly upon modifications of the pericarp; and these are interesting, not merely as systematic differential signs, but also as morphological grades.

(3851.) The first subtype, *Arabidæ*, is called also *Pleurorhizeæ*, because the 2 cotyledons are flat and accumbent; that is, the embryo is so curved that the radicle lies on the edges of both. [Vide fig. *a, b, c.*] In the other subtypes the radicle is folded on the side of one of the cotyledons; and this form is said to be incumbent. [Vide fig. *d, e, f,* &c. &c.]



(*a*) A seed with an accumbent radicle, one of the *Pleurorhizeæ*. (*b*) A transverse section of the same, to shew the radicle applied to the edges of the two cotyledons. (*c*) The symbol by which such a position is indicated, the circle representing the cut radicle, and the two parallel lines the two cotyledons. (*d*) A seed, shewing the radicle incumbent or folded on the back of the cotyledons, which in this instance are plane, it being one of the *Notorhizeæ*. (*e*) Transverse section of the same. (*f*) The symbol by which it is represented, the circle as before indicating the radicle, and the two parellel lines the two cotyledons. (*g*) A seed with incumbent radicle and straightly folded cotyledons, one of the *Orthoploceæ*. (*h*) A transverse section of the same. (*i*) The symbol by which this form is represented, the circle indicating the radicle, and the angular lines the bent cotyledons. (*k*) A seed with incumbent radicle and circinnate or spirally folded cotyledons; one of the *Spirolobeæ*. (*l*) A transverse section. (*m*) The symbol by which this form is represented, the circle indicating the radicle and the two sets of parallel lines the cotyledons, which are twice cut through. (*n*) A seed with an incumbent radicle and doubly folded cotyledons, one of the *Diplecolobeæ*. (*o*) A transverse section of the same. (*p*) The symbol by which this form is represented; the circle indicating the radicle cut across, and the 3 pairs of parallel lines the cotyledons, which in the section are thrice divided.

(3852.) The second subtype, *Sisymbridæ*, is called also *Notorhizeæ*, because the incumbent cotyledons have the radicle folded on their back. [Vide § 3851, *d, e, f.*]

(3853.) The third subtype, *Raphanidæ*, is called also *Orthoploceæ*, because the incumbent cotyledons are folded lengthwise. [Vide § 3851, *g, h, i.*]

(3854.) The fourth subtype, *Erucaridæ*, is called also *Spirolobeæ*, because the incumbent cotyledons are spirally folded or circinnate. [Vide § 3851, *k, l, m.*]

(3855.) The fifth subtype, *Subularidæ*, is called also *Diplecolobeæ*, because the incumbent cotyledons, or seed lobes, are twice bent or folded. [Vide § 3851, *n, o, p.*]

(3856.) The sixth subtype, *Schizopetalidæ*, differs from all the preceding in the number of the cotyledons, which are four.

(3857.) None of the *Brassicaceæ* are really poisonous plants, but some of them are very acrid. They are esteemed as antiscorbutics, and afford many of our most common culinary vegetables. Some are mild and almost tasteless, while others are highly stimulating. Their pungency is owing to a peculiar volatile oleaginous principle, which is occasionally so predominant as to render them acrid, yet in others its proportion is so much reduced as to render them merely grateful stimulants; but it is only when the bland farinaceous matter is exceedingly abundant that they become palatable and wholesome articles of food. The roots of the horseradish, and the seeds of the mustard, garden-rocket, and cress, are so stimulating, as to prevent their being eaten alone, although they form grateful condiments. The leaves of the water-cress, some of the land-cresses, and others,

are eatable as salads, being only agreeably warm. And the leaves of the coleworts, and the mass of their inflorescence, and the leaf-stalks of the sea-kale, with the roots of the turnip, the radish, &c. are well-known staple articles of food. The seeds of the Brassicaceæ abound with a fixed oil, which is yielded freely on expression; and that of the mustard and rape are used for economical purpose. These plants are further remarkable for containing a proportion of nitrogen as one of their elements, which, although constant in animal substances, is very rare among vegetables; and to it the *Brassicaceæ*, like the *fungi*, in which it also occurs, owe their peculiar flesh-like odour, and the offensive effluvia that arise from them when in a state of decomposition.

(3858.) *Arabidæ.* This subtype is distributed by De Candolle into six districts or tribes, called, from *Arabis*, *Alyssum*, *Thlaspi*, *Euclidium*, *Anastatica*, and *Cakile;* the *Arabideæ*, *Alyssineæ*, *Thlaspieæ*, *Euclideæ*, *Anastaticeæ*, and *Cakalineæ*. These groups, besides having pleurorhizous embryos, their chief collective differential sign, have also their seeds compressed.

(3859.) In the *Arabideæ*, or *Pleurorhizeæ Siliquosæ*, the silique is dehiscent, the dissepiment linear, the seeds oval, usually margined, and the lobes parallel with the replum.

(3860.) In the *Alyssineæ*, or *P. Latiseptæ*, the silique is dehiscent lengthwise, the dissepiment broad, oval, and membranous; the valves flat or concave, the seeds usually margined, and the lobes parallel with the replum.

(3861.) In the *Thlaspideæ*, or *P. Angustiseptæ*, the silicle is dehiscent, with a very narrow dissepiment and keeled valves. The seeds oval, sometimes margined, and the lobes not parallel with the dissepiment.

(3862.) In the *Euclideæ*, or *P. Nucamentaceæ*, the silicle is indehiscent, sometimes coriaceous, and sometimes fleshy. The valves concave and indistinct, the dissepiment elliptical or occasionally almost abortive; seeds few and oval, and the lobes parallel with the dissepiment.

(3863.) In the *Anastaticeæ*, or *P. Septulatæ*, the silicle opens longitudinally, but the valves, which are concave, bear internally transverse septa, isolating the seeds, which are immarginate, and with lobes parallel to the dissepiment.

(3864.) In the *Cakilineæ*, or *P. Lomentaceæ*, the silique or silicle ruptures transversely, like a loment, into 1-2 celled, 1-2 seeded joints. The seeds are immarginate, and the lobes parallel with the dissepiment.

(3865.) *Arabideæ*. *Matthiola*, the stock, of which there are several well-known garden species; and *Cheiranthus*, the wall-flower, of which there are several varieties, are familiar illustrations of this district, but they are rather ornamental than useful plants.

(3866.) *Nasturtium officinale* is the common water-cress, lately brought under cultivation, but the plants collected wild are superior in flavor. They are brought in immense quantities into this metropolis, being collected from the neighbouring streams, and form an important though humble branch of domestic commerce. *N. apetalum*, *clandestinum*, and *Indicum*, are destitute of corollæ.

(3867.) *Barbarea vulgaris*, St. Barbara's cress, or yellow rocket, is used in the north of Europe, especially in Sweden, as kale; it forms, however, but an inferior potherb. *B. præcox*, the early rocket, or winter cress, is much more palatable. The double-flowered rocket, *B. vulgaris flore pleno,* is an ornamental garden plant.

(3868.) The different species of *Arabis*, or wall-cress, are well fitted to cover walls and rock-work. The seeds of *A. Sinensis* are said by Ainslie to be used in India as a stimulating stomachic; and they are sold in the bazaars in large quantities. If taken too freely, they are however thought to be injurious to females.

(8369.) *Cardamine pratensis*, the meadow-cress, or lady's smock, was once esteemed as an antiscorbutic and diuretic. Its leaves form a very good salad, but it is seldom eaten. *C. Chelidonia* has been also extolled for its antiscorbutic powers.

(3870.) *C. Impatiens* is remarkable for the elastic dehiscence of its pods and sudden dispersion of its seeds, an economy similar to that of the true '*touch-me-not!*'

(3871.) The *Dentariæ*, or toothworts, are so called from the appearance of their scaly rhizomata. They are well deserving cultivation as ornamental plants. *D. diphylla* has a pungent flavour, something like mustard; and in North America it is used as a condiment under the name of *pepper-root*. *D. bulbifera* is remarkable for bearing bulbils in the axillæ of its leaves, which separate spontaneously and propagate the plant.

(3872.) *Alyssineæ*. *Lunaria*, the *moonwort* or *honesty*, has been employed both as food and medicine. The seeds are aperient and diurectic, and its roots form a good ingredient in salad, resembling rampions in their flavour. Its broad shining moonlike dissepiments, after the silicles have dehisced, are much sought after for winter beaupots. *L.* (now *Farsetia*) parviflora, which grows in the sterile sandy plains of Egypt and Arabia, is the cress of the desert spoken of by travellers; by the Arabs it is called *Raschat-guébeli*.

(3873.) The Alysson of Dioscorides was reputed to have the power of moderating and appeasing anger, and hence its name, from *α*, the privative, and *λυσσα*, rage. The modern *Alyssa*, or madworts, are aperient plants, some of them with shewy flowers; and, probably, a brisk cathartic might not be an inefficacious means of curing such a temporary madness.

(3874.) *Cochlearia officinalis*, is the scurvy grass, once in great repute as a spring medicine; its leaves have also been eaten as salad. *Cochlearia Armoracia* is the common horseradish; its roots are a very grateful condiment, and without them our national fare is seldom brought to table. When fresh, the juice of the horseradish is stimulating and highly acrid, but when dried it loses its powers. It has been used as an excitant in cases of paralysis, and also as a stimulating diuretic in dropsy. Steeped in cold milk, it is said to form one of the best cosmetics. The leaves of the horseradish, in general simple, entire, and plane, are sometimes found crisp, with an enlarged lamina; and at others cleft by an elongated midrib, thus affording excellent illustrations of the varied predominance of the axial and radial forces.

(3875.) *Thlaspideæ*. The several species of *Thlaspi*, *Hutchinsia*, *Teesdalia*, and the other genera included in this district, are for the most part homely plants, with, in general, inconspicuous flowers. Their leaves have often a pungent taste, and sometimes an alliaceous flavor, but they are none of them used either as food or in medicine. Some species of *Iberis* and *Biscutella*, which are more ornamental than the rest, are favorites in gardens, and commonly known as the different kinds of candy tuft. *I. odorata* is fragrant as well as pretty; and the whole genus is remarkable for the cruciform corolla becoming irregular, the two outer petals of the external flowers in its dense corymbose panicles being longer than their fellows, and even ligulate.

(3876.) *Euclidieæ.* *Euclidium*, *Ochthodium*, and *Pugionum*, are the only known genera referable to this district, which is chiefly interesting from the silicles being indehiscent, and the replum abortive, or nearly so. The seeds are very few, sometimes even solitary. Of the four known species, none have hitherto been applied to any economical purposes.

(3877.) *Anastaticeæ.* The two genera, *Anastatica* and *Morettia*, each including but a single species, form together this small district, which is systematically distinguished on account of its marking a peculiar change in the structure of the fruit, intermediate between a silicle and a loment. For here the pods not only dehisce longitudinally, but bear within their valves transverse septa, which render them many-celled.

(3878.) *Anastatica Hierochuntica*, the rose of Jericho, or holy-rose, is a very curious plant. It grows in the sandy wastes of Egypt, Palestine, Syria, and Barbary, especially on the arid plains bordering the Red Sea. After flowering the leaves fall off, and the branches becoming dry curl upwards, bend inwards at their extremities, and surround the fruit, thus forming a globular mass, bearing some resemblance in form to a rose, whence it has been called the *Rose of Jericho.* Thus contracted into a ball, the plant is readily torn up by the winds, and rolled over the plains to indefinite distances; but when blown into the sea, or moistened by rain, the branches, which are very delicate hygrometers, gradually expand, the pods open, and the seeds are discharged at the only time and under the only circumstances in which they could vegetate; for, were they, like the seeds of most other vegetables, to be scattered during the dry seasons, they would be parched up, and their vitality destroyed in those vast burning sandy deserts which they now at intervals adorn.

The generic name, *Anastatica*, has reference to the apparent revivification which the plant undergoes on exposure to moisture; for if, after being kept dry for years, it be placed for a few hours in water, it will expand its branches and open its roselike flowers, seeming as if roused from sleep, or raised from the dead. The common people in Palestine believe that this plant blossomed at the instant the Saviour was born, and that now, if put into water when the first maternal pains come on, it will be fully opened by the birth of the infant, and that the degree of its expansion is an index of the progress of the labour; hence it has been called Kaf Maryam, St. Mary's flower, or the Holy Rose.

(3879.) *Cakilineæ.* This district, like the two preceding, is very small, containing only the three genera, *Cakile*, *Cordylocarpus*, and *Chorispora*, and, like them, is distinguished systematically, on account of its pods being lomentaceous and rupturing transversely, as in the loments of the Cicerinæ. *Cakile maritima* is said to be a brisk cathartic, and it, as well as the other species, have been recommended as diuretics and antiscorbutics. *Chorispora Iberica* is a stimulating emmenagogue; its seeds are remarkable for their nauseous smell when bruised.

(3880.) SISYMBRIDÆ. The genera included in this subtype have been arranged by De Candolle in five smaller groups, called, from *Sisymbrium*, *Camelina*, *Lepidium*, *Isatis*, and *Anchonium;* the *Sisymbrieæ*, *Camelineæ*, *Lepidineæ*, *Isatideæ*, and *Anchonieæ.* Besides their notorhizous embryos, the seeds in all these groups are oval and immarginate.

(3881.) The *Sisymbriæ*, or *Notorhizæ Siliquosæ*, are *Sisymbridæ*, with 2-celled siliques opening lengthwise, the valves concave or keeled, the seeds ovate or oblong, and the lobes not parallel with the dissepiment.

(3882.) The *Camellineæ*, or *N. Latiseptæ*, are *Sisymbridæ*, with silicles, having concave valves and broad elliptical dissepiments; seeds ovate, and the lobes contrary in their position to the replum.

(3883.) The *Lepidineæ*, or *N. Angustiseptæ*, are *Sisymbridæ*, with silicles, having very narrow dissepiments, keeled or very concave valves, seeds ovate, few or solitary, and the lobes parallel with the replum.

(3884.) The *Isatideæ*, or *N. Nucamentaceæ*, are *Sisymbridæ*, with a 1-celled silicle, the replum being abortive, with indistinct or indehiscent keeled valves, a solitary seed, and the lobes parallel with the plane in which the replum should have been.

(3885.) The *Anchonieæ*, or *N. Lomentaceæ*, are *Sisymbridæ*, with transversely dehiscent pods, resembling loments, each joint being 1-seeded.

(3886.) *Sisymbrideæ.* The genera *Malcomia* and *Hesperis* contain several ornamental species; some of which, as the night-rocket, or dame's violet, are very fragrant. The *Sisymbria* are warm stimulating plants; but, now that the water-cress is excluded from the genus, they are none of them much used as food. *S. officinarum* was formerly esteemed as an expectorant in asthma and chronic pectoral complaints. Cullen recommended its juice to be taken mixed with honey or sugar, in which form it seems to be also serviceable in ulceration of the mouth and fauces. *S. Sophia*, the *Flix-weed*, was also once much valued as a remedial agent in dysentery, and as serviceable in hysteria; indeed, so potent was it believed to be, that in the old herbals it is called "The wisdom of surgeons." Its pulverized seeds, if mixed with gunpowder, are said to increase its explosive force.

(3887.) *Alliaria officinalis* is the Jack-by-the-hedge, or sauce alone, of the peasants in our distant provinces: its leaves have a strong smell and taste of garlic, hence they form a very savory sauce. When boiled, Neill says, it makes a most desirable potherb, being excellent with boiled mutton, and any kind of salted meat. According to the experiments of Linneus, it is refused by horses and goats, but sheep and cows will feed upon it, and poultry will also eat it: it however imparts an unpleasant flavor to the milk of the one, and to the flesh of the other. The powdered seeds have been used as sternutories.

(3888.) The *Erysima*, or *treacle mustards*, are plants, the leaves of which have a pungent taste, and their juices are said to be so acrid as even to inflame the skin and produce vesications; but no use is made of them either as food or medicines.

(3889.) *Stanleya pinnatifida*, in habit, and the fleshiness of its leaves, something resembling the cabbage, has been tried as a culinary vegetable, but it is found not to be fit for food, as, when it is boiled, it becomes powerfully emetic.

(3890.) *Camelineæ.* The *ground-flax*, *Camelina*, a corruption of *Chamælina*, (from χαμαι and λινον,) is a genus containing very homely-blossomed plants, notwithstanding the pompous provincial name, *Gold-of-pleasure*, which is thought to have a satirical reference to the disappointment gold spent on pleasure falsely so called entails. *C. sativa* (olim *Myagrum sativum*,) is cultivated for the sake of its seeds, from which an abundance of fixed oil is obtained by expression, fit for most of the common domestic purposes to which oil is applied.

(3891.) *Lepidineæ.* *Capsella Bursa-pastoris*, the shepherd's purse, so well known as a troublesome weed, is less acrid than most of its associates; and its

leaves, which are mucilaginous, might be used as potherbs, were we not already well supplied.

(3892.) *Lepidium*, the pepper-cress, is warm and stimulating, as well as mucilaginous. *L. sativum*, the common garden-cress, forms with mustard one of the earliest of our spring salads; the curled leaved variety is a more elegant vegetable than the plain, but it is less cultivated. The broad leaved variety is grown for the purpose of feeding young turkies. *L. piscidium* is said to have the property of intoxicating fish; and in the Society Isles the plant is used in their capture by the natives. It has been eaten as a salad, but is found to be too pungent to be agreeable. *L. latifolium*, the poor-man's pepper, has a very hot and acrid taste; it was once used instead of horseradish, and is still occasionally eaten as a condiment.

(3893.) *Isatideæ*. *Isatis*, the woad, was once a plant of great commercial importance: all the species afford from their leaves a blue dye, much in request before the introduction of indigo. It was cultivated in many parts of this country, especially in Somersetshire; and *Glastonbury* received its name from *Glastum*, the old name of the plant, which is a derivative of *glas*, the Celtic word for blue. The ancient Britons are said to have painted their bodies with the blue colour obtained from this plant. The leaves are fermented, and the woad dye extracted in a manner very similar to that adopted in the preparation of indigo; and for a long time a strong prejudice existed against the foreign blue, which was kept up, if not excited, by the growers of woad. [Vide § 2073, et seq.]

(3894.) *Anchonieæ*. This small district contains only the 3 genera, *Anchonium*, *Goldbachia*, and *Sterigma*, which are distinguished, like the *Cakilineæ* of the preceding subtype, by the pods being lomentaceous and rupturing transversely.

(3895.) RAPHANIDÆ. This subtype includes five districts, or subordinate groups of genera, distinguished from each other, as in the preceding, by the modifications of their fruit, and called, from *Brassica*, *Vella*, *Psychine*, *Zilla*, and *Raphanus*, the *Brassiceæ*, *Velleæ*, *Psychineæ*, *Zilleæ*, and *Raphaneæ*. The seeds in this subtype are in general globose, always immarginate, and the style usually enlarged.

(3896.) The *Brassiceæ*, or *Orthoploceæ Siliquosæ*, are Raphanidæ, having siliques, with valves dehiscent lengthwise, and a linear replum.

(3897.) The *Velleæ*, or *O. Latiseptæ*, are Raphanidæ with silicles dehiscent lengthwise by valves, which are concave. The replum is elliptical, and the seeds globose.

(3898.) The *Psychineæ*, or *O. Angustiseptæ*, are *Raphanidæ*, having keeled silicles, very narrow dissepiments, and the seeds compressed.

(3899.) The *Zilleæ*, or *O. Nucamentaceæ*, are *Raphanidæ*, with ovate or globose, 1-celled, 1-seeded, indehiscent silicles. The valves indistinct, and the seeds globose.

(3900.) The *Raphaneæ*, or *O. Lomentaceæ*, are lomentaceous *Raphanidæ*, with the siliques or silicles rupturing transversely into joints or cells, containing each 1 or a few seeds, which are globose.

(3901.) *Brassiceæ*. The *Cole*, or *Kail* (*Brassica*), and the *Mustard* (Sinapis), are the most important genera included in this district. Of the former there are many species, one of which, *B. oleracea*, has been cultivated from time immemorial; and the varieties which have resulted from its domestication are most

numerous. Few plants, indeed, afford better illustrations of the effects of culture; for the sea-colewort or wild cabbage, which is indigenous on our coasts, bearing in its rude condition a few small scattered leaves and meagre blossoms, is the source or parent of our giant cabbages, both red and white, of our delicate brocoli, and splendid cauliflowers. The varieties of *B. oleracea* have been arranged in six tribes, or subspecific groups; and these may perhaps be most conveniently exhibited in a tabular form.

BRASSICA. OLERACEA.	*Sylvestris.*	Wild cabbage or sea colewort	
	Acephala. Kales.	Racemosa	Cavalier or 1000-headed
		Vulgaris	Hundred-leaved
		Viridis	Green ditto
		Purpurascens	Red open-headed
		Quercifolia	Oak-leaved borecole
		Sabellica	Scotch kale or Siberian borecole
		Germanica	Curled kale or curlies
		Pinnata	Jagged kale
		Laciniata	Ragged jack
		Judaica	Jerusalem kale
		Ruthenica	Buda ditto
		Versicolor	Variegated ditto
		Purpurascens	Brown or purple ditto
		Palmifolia	Palm ditto
		Arborescens	Cæsarean kale or tree cabbage
		Costata	Ribbed kale
		Nepenthiformis	Cup-leaved ditto
	Buliata. Savoys.	Vulgaris	Savoy cabbage
		Viridis	Green ditto
		Lutea	Yellow ditto
		Præcox	Early savoy
		Humilis	Dwarf ditto
		Turionensis	Turaine ditto
		Aurita	Eared cabbage
		Oblonga	Winter savoy
		Major	Giant ditto
		Gemmifera	Brussels sprouts
		Selinoides	Parsley-leaved
	Capitata. Cabbages.	Depressa	Drum-head
		Spherica	Common round
		Alba	White Scotch
		Rubra	Red Aberdeen
		Subrubens	Blush cabbage
		Obovata	Pentonville ditto
		Elliptica	York ditto
		Conica	Sugar-loaf or Battersea ditto
	Caulorapa. Kohls.	Communis	Common kohl-rabi
		Alba	White ditto
		Purpurascens	Violet ditto
		Crispa	Curled or fringe-leaved ditto
	Botrytis. Flower-coles.	Cauliflora	Cauliflower
		Alba	White ditto
		Rubra	Red ditto
		Asparagoides	Brocoli
		Communis	White ditto
		Violacea	Purple or Maltese ditto
		Viridis	Green brocoli
		Fusca	Brown ditto
		Lactea	Cream-coloured ditto
		Sulphurea	Brimstone ditto
		Danica	Siberian or Danish ditto, &c. &c.

(3902.) *Brassica oleracea sylvestris*, the wild colewort or cabbage, is esculent even in its uncultivated condition; but it forms a potherb very much inferior to the worst we are accustomed to meet with.

(3903.) The thousand-headed and the hundred-leaved varieties are chiefly cultivated as fodder for cattle. The oak-leaved borecole is a good table variety.

All the subvarieties of Scotch kale are excellent potherbs, much esteemed for culinary purposes, and in general cultivation. The variegated form is a very ornamental plant.

The palm-kale and the tree-kale, or Cæsarean cow-cabbage, are both arborescent varieties, the first growing to the height of 10 or 12 feet; and the latter is said, in La Vendée, even to reach sixteen feet: their stems are simple, and crowned with tufts of leaves, therefore something resembling palms in port. The heart of the bud is tender and palatable; the outer leaves are given as fodder to cattle, for which purpose the former is cultivated extensively in Jersey, and the other Anglo-Norman isles.

The ribbed kale is much esteemed, and commonly grown on the Continent; it is not, however, often met with in Britain: and the cup-leaved kale, which is a very interesting form, is grown merely as a curiosity.

(3904.) Of the savoys there are many subvarieties, and all deservedly esteemed as winter potherbs, and, with good management, they can be kept in an esculent condition for nine or ten months in the year.

(3905.) Numerous kinds of each of the capitate subvarieties are grown according to the soil of different localities, and the seasons at which they are required as food. Thus, of the sugar-loaf, we have the solid and hollow kinds, with 14 other sorts, varying more or less in form, colour, &c.; hollow and solid Yorks, Bainbridge's, and the common drumhead, and several sorts of red cabbage, besides the large round, and the Strasburg, from which latter the celebrated sour-kraut is chiefly made.

(3906.) The Kohl-rabi, or turnip-stemmed cabbage, of which there are several subvarieties, has been but lately introduced into this country, and is chiefly grown as fodder for cattle. Both the leaves and tumid stems are esculent; but, unless very young, their taste is rank, and not over palatable.

(3907.) "Of all the flowers in the garden I like the cauliflower," was a favorite saying of Dr. Johnson; and in truth it merits no niggard commendation. The parts, however, which are prized as food, are not really the flowers, which are not evolved when the plant is cut for use, but the enlarged and succulent flower-stalks. The red cauliflower is thought to be more hardy than the white, but it forms a less elegant dish. The brocoli so closely resembles the cauliflower, that they are scarcely distinguishable from each other by structural characters. The stems are usually taller and the leaves longer, and the upper parts of the peduncles are more developed and fleshy in the brocoli than in the cauliflower, where the lower stalks are chiefly enlarged; but these distinctions are unsatisfactory: and there are many intermediate kinds which run so much into each other that the two subvarieties become inseparable.

(3908.) *Brassica campestris* is the *Navew* or Navet, of which there are several important varieties; as

B. C. Oleifera. The colsa or colza, which is cultivated for the sake of its seed, known as cole-seed, from which large quantities of oil are expressed, the

refuse marc, as well as the leaves, being given as fodder to them. The burned haum also forms an excellent manure.

B. C. Pabularia is grown on the Continent as fodder for sheep.

B. C. Napo-brassica is the turnip-rooted cabbage, of which there are two sub-varieties, viz. the common turnip-rooted cabbage, here but little cultivated, although it is a frequent potherb on the Continent, its roots being as sweet as those of the turnip; and, secondly, the *Rutabaga,* so well known in husbandry as the Swedish turnip.

(3909.) The common turnips are varieties of *Brassica Rapa; B. R. depressa* affording the several kinds of flat or roundish turnips, and *B. R. oblonga* the tankard or decanter sorts. These vary much in colour, some being white, some red, some yellow, some green, and others nearly black. The first four are in the most general cultivation, and these differ in their form and seasons of maturity. The black Russian is seldom, if at all, to be met with, and is even thought to be extinct. The value of turnips as food for man and fodder for cattle, and particularly their importance in husbandry as rotation crops, are subjects too well known to need or admit of comment. Both their grumous roots and leaves are esculent, but they contain a very small proportion of really nutritious matter; according to the experiments of Sir Humphry Davy, not more than 42 parts in a 1000. Turnips, and all kinds of kale and cabbages, with the exception of cauliflowers, are found to be much better flavoured when grown in fields than when cultivated in gardens.

(3910.) *Brassica Rapa oleifera,* is the rape, of Dauphiny, from the seeds of which a useful oil is expressed. It is less productive than the common *rape* and *Colza;* but it has this advantage, that it will grow in soils unfavorable to all other oil-bearing plants.

(3911.) *Brassica Napus* is the *Navette,* reps, or rape: one variety, *B. N. oleifera,* is the British rape, grown extensively both in this country and in the eastern parts of Europe, for the sake of its seed, whence rape-oil is expressed. It is also valued as winter fodder for sheep; and it is sown, like cress and mustard, for early salad.

B. N. esculenta, the French turnip, is often confounded with the Swedish and common turnips, and in general appearance they very greatly resemble each other; but B. Rapa may be readily distinguished by its hispid leaves, those of the others being smooth and glaucous, excepting the early foliage of the Swede, (B. C. Rutabaga,) which is slightly hairy. On the Continent this variety is much esteemed as an ingredient in soups, as it imparts a more powerful flavour than any of the other kinds; and the roots are very ornamental, varying in colour from white to yellow, and black: but they are not so sweet or palatable eaten alone as the common kinds, and are chiefly prized as seasonings.

(3912.) *Sinapis nigra,* and *alba,* are the black and white mustards of commerce. Other species are acrid and pungent, such as the *S. arvensis,* the *corn mustard* or *charlock,* but less so, or of a less agreeable flavour, than the two which are in common cultivation. The mustard seeds consist of mucilaginous and farinaceous matter, combined with a bland fixed oil, and a volatile or essential one of great pungency. The acridity of this latter is increased by keeping the seeds for a moderate time after collection, or at once developed by the addition of vinegar. The fixed oil expressed from the seeds of the white mustard is bland and tasteless, while the marc or cake left, after the expression, being deprived of so much mild insipid matter, is more acrid than the seeds in their original condition. The oil

is excellent for all ordinary domestic purposes. Nitrogen exists in the seeds as well as other parts of these plants, whence the presence of ammonia and ammoniacal salts, and their peculiar animal odour may be easily accounted for. White mustard seeds have at different periods been popular as stimulating cathartics, and in leucophlegmatic habits the taking one or two tablespoonsful of the unbruised seeds would seem to have been beneficial; for, in their passage through the intestines, they give out but a small proportion of their pungent principles, and these are obtunded by the mucilage with which they are combined: ulceration of the intestines and death have, however, been known to occur from some of these acrid seeds lodging in the vermiform appendix of the cæcum. A case of fatal enteritis, thus produced, has been recorded by my friend, Professor Wheeler, in his Chelsea Catalogue. The seeds of mustard are not only remarkable for the rapidity of their development, so that it has been said a salad might be grown while a joint of meat was being roasted, but also for their tenacity of life, for where a crop of mustard has been once seeded, self-sown stragglers will come up for a century afterwards.

(3913.) *Erucaria sativa* is one of our old garden vegetables; and, although now but little cultivated in Britain, three centuries ago it formed one of our more common culinary herbs. It has a strong and peculiar smell, which many persons would consider nauseous, and this has probably tended to its neglect. On the Continent it is still grown as an early salad.

(3914.) *Velleæ. Vella, Boleum, Carrichtera, Succowia,* and *Savignya,* included in this district, are, in an economical point of view, not very important vegetables. *Savignya Ægyptiaca,* already mentioned under the name of *Farsetia parviflora* [§ 3873], is an ornamental sand or rock plant; and *Carrichtera Vellæ,* which is acrid and pungent, might, if required, be used as a condiment.

(3915.) *Psychineæ. Schouwia* and *Psychine,* each containing but a single species, are in a similar predicament with the preceding group. The latter is a curious plant, with winged or butterfly-shaped silicles. They are systematically distinguished on account of their narrow repla, a structural character of value in this group.

(3916.) *Zilleæ. Zilla, Muricaria,* and *Calepinia,* which form this district, are in like manner separately noticed in consequence of the structural peculiarity of their fruit, which is a nucamentaceous silicle. The leaves of *Z. Myagroides,* which is a native of Upper Egypt, are eaten by the Arabs when boiled as a substitute for cabbage.

(3917.) *Raphaneæ.* The sea-kale (*Crambe*), and the radish (*Raphanus*), are familiar examples of this, the lomentaceous district of the Orthoploceous Brassicaceæ, or *Raphanidæ.*

(3918.) The young shoots of *Crambe maritima,* which is a native of our sea-coasts, have in the west of England been time out of mind collected by the peasants and eaten as a potherb; but it was not until the middle of the last century that it was introduced into general cultivation, nor until within the last ten or fifteen years that it has become a cheap and common vegetable. Now it is raised in vast abundance in the neighbourhood of London, and sold at a very low price. It is one of the easiest vegetables to force, one of the earliest, and one of the most delicate, being very little, if at all, inferior to asparagus. The flowers of the sea-kale are a very favorite resort of bees. Other species, such as *C. Tartarica,*

of which there are several varieties, have esculent roots; and hares are very fond of their herbage. The root of *C. cordifolia* is nearly as pungent as horseradish; and the stems and leaves of most of the species are, when growing wild and unblanched, too acrid to be eatable.

(3919.) The garden radish (*Raphanus sativus*), is too well known to need description. Of it there are two chief tribes or families, *R. niger*, the dark or winter radish; and *R. radicula*, the summer radish. Of each of these tribes there are several subvarieties, the principal of which are the rotund or turnip radish, and the fusiform or carrot-shaped radish. Both of these differ, not only in form but also greatly in colour, varieties being known which pass from white through almost every shade of red, to a dark purple approaching black. The roots and leaves of radishes are generally eaten raw as salads: formerly the leaves were boiled as potherbs; and the roots, when boiled and served with toast and butter, seasoned with pepper, have much the taste of sea-kale or asparagus, and form a very palatable dish.

(3920.) *R. caudatus* is remarkable for the length of its pod, which is greater than the whole height of the plant. *R. Landra* is eaten as a salad in Italy; and the roots of *R. maritimus* are said by Dr. Walker to be pungent, and as a condiment preferable to horseradish. Its leaves form a favorite food with cattle.

(3921.) *R. Raphanistrum* is the wild radish, or jointed charlock, which so commonly infests the cornfields in the North of Europe: its seeds, when mixed and ground with the corn, were supposed by Linneus to produce that dangerous spasmodic disorder called, from it, Raphania. But, although this disease is epidemic in Sweden, it is unknown in England, and other countries, where charlock grows freely as a corn-weed; and, as before observed, [vide 554,] its deleterious effects are more probably owing to a morbid condition of the seeds, or to the growth of noxious fungi on them, than to any inherent unwholesome principle.

(3922.) ERUCARIDÆ. This subtype includes only two genera, but which differing essentially from each other in the structure of their fruit, they have, in deference to the principle observed in the preceding groups, been considered as the normal genera of two districts, called the *Buniadeæ*, and *Erucarieæ*.

(3923.) The *Buniadeæ* are *spirolobous Brassicaceæ* or *Erucaridæ*, with nucamentaceous silicles, 2-4 celled, and indehiscent.

(3924.) The *Erucaridæ* are *spirolobous Brassicaceæ* or *Erucaridæ*, with 2-jointed lomentaceous siliques; the lower joint being 2-celled, and the upper one sword-shaped.

(3925.) The leaves of the *Erucaridæ* have a warm, pungent flavor, but they are not used either as food or medicine.

(3926.) SUBULARIDÆ. This subtype, which includes the diplecolobous Brassicaceæ, or all those cruciferous genera in which the seeds are depressed and have their cotyledons twice folded, is distributable into three minor groups or districts, called respectively the *Heliophileæ*, *Subularieæ*, and *Brachycarpæeæ*.

(3927.) In the *Heliophileæ*, or *Diplecolobeæ siliquosæ*, the siliques are elongated, rarely oblong or oval; the septum linear or oval, and the valves flat, or in the lengthened pods slightly convex.

(3928.) In the *Subularieæ*, or *D. latiseptæ*, the silicle is oval with an elliptic septum, convex valves, many-seeded cells, and a sessile stigma.

(3929.) In the *Brachycarpeæ*, or *D. angustiseptæ*, the silicle is didymous, the septum very narrow, the valves ventricose, the cells 1-seeded, and the style short.

(3930.) The *Subularidæ* are interesting to the organologist from the varied modifications of their fruit, but they are not economically important, as none of them are used either as food or medicine.

(3931.) *Subulariæ. Subularia aquatica* is a curious plant, which blossoms several feet below the surface of the water. According to Sir J. E. Smith and Dr. Hooker, the flowers always remain submerged, even during the time they are expanded; thus forming a remarkable deviation from the general rule, for water-plants almost invariably emerge their flowers before the petals open, in order that fertilization may take place in air.

(3932.) *Brachycarpæeæ. Brachycarpæa varians,* which stands alone in this district, is noticeable for its shrubby habit, as suffruticose plants are very rare in this natural association.

(3933.) SCHIZOPETALIDÆ. *Schizopetalon Walkeri* is separated from all the other *Brassicaceæ,* on account of its tetracotyledonous embryo. This peculiarity of structure may have some connexion with its cleft petals. It is, however, a remarkable circumstance; and hence the plant stands alone in this subtype, with which the Cruciferæ conclude.

(3934.) CAPPARIDACEÆ. *Capparis, Cleome,* and their typical allies, are herbs, shrubs, or small trees, with aqueous juices, alternate, simple or palmate, petiolate leaves, and stipules absent or spinescent.

The inflorescence is variable, either solitary or racemose, and the flowers pedicelled, and united or monothalamous, rarely by abortion dithalamous or separate.

The calyx is free, formed of 4 sepals, equal or unequal, in general discrete,

A

Capparis Ægyptiaca.

A. Cutting, to shew leaves and flowers.

(*a*) Flower separated.

(*b*) Calyx and pistil, the petals and stamens being removed.

(*c*) Transverse section of the fruit.

(*d*) Seed.

(*e*) Section of ditto, to shew the embryo, and tumid endoderm.

(*f*) The embryo isolated.

but sometimes coalescent by their edges, and forming a tube with a variable edge, and, as well as the corolla, imbricate in æstivation. The petals are 4, cruciform in their arrangement, and usually unguiculate and unequal: they are exserted from the base of the torus, alternate to the sepals, and are very rarely abortive.

(In Arsis alone are they, as well as the sepals, 5 in number.) The stamens are definite or indefinite, exserted from a torus, which is either free or slightly coherent to the bottom of the calyx, and hence they are almost perigynous. The filaments are free or connate, and often quaternary in their arrangement; very seldom unequal in height, or subtetradynamous, as in *Physostemon* and *Cleome*. The anthers are suberect or incumbent, cleft at the base, 2-celled, with parallel locules dehiscent by clefts, and no apparent connectivum. The torus is hemispherical or elongated, forming a thecaphore or support to the germen, and is often glanduliferous. The ovary, in general stipitate, is formed of 2 (seldom more) connate carpels, with many-ovuled parietal trophosperms, a single columnar style, short or absent, and for the most part a disk-like stigma.

The fruit is variable, either siliquose and dehiscent, or baccate and indehiscent, and unilocular, (rarely 2 or more celled,) placentæ 2 (seldom more), parietal, intervalvular, and many-seeded; but sometimes, though seldom, 1-seeded by abortion. The seeds are oblique, attached by short podosperms, exarillate, and usually kidney-shaped. The albumen is absent, but the endopleure or endoderm is tumid. The embryo is curved, with the radicle turned towards the hilum, the cotyledons foliaceous, nearly flat, and subincumbent.

(3935.) Hence, selecting the chief differential characters, the CAPPARIDACEÆ (or *Capparideæ*) are cruciform *Rhæadinæ*, with definite or indefinite stamens, rarely, if ever, tetradynamous, concrete carpels, a continuous enlarged disk, a stipitate 1-celled ovary, narrow simple parietal placentæ, and reniform exalbuminous exarillate seeds, with a tumid endoderm.

(3936.) De Candolle observes that, from the structure of the flowers in the Capparidaceæ, the group is intermediate between the thalamiflorous and calyciflorous suborders, *i.e.* these plants establish another of those numerous connexions either of direct affinity or indirect analogy, which have already so often been shewn to exist between the Myrtosæ and Rhæadosæ, as well as in other parts of the vegetable world. The subperigynous exsertion of the stamina and adherence of the disk to the calyx, or its elevation of the germen, approaches the Capparidaceæ, in the first place, to the *Rosaceæ*, nearly opposite to which they are arranged in the scale of affinities, and in the second to the *Passifloraceæ*, which have already been described as having stipitate ovaries. They are also connected to the *Droseraceæ* and *Flacourtiaceæ* by the structure of their fruit, but are distinguished from both by their exalbuminous exarillate seeds, which are never invested by a pulpy pellicle. Their immediate relationship with the Brassicaceæ is evident in their cruciate flowers, which are occasionally tetradynamous, and their siliquose fruit, as well as by their general properties.

(3937.) The genera here associated are distributable into two subtypes, which, from *Cleome* and *Capparis*, have been called the CLEOMIDÆ (or *Cleomeæ*,) and CAPPARIDÆ (or *Cappareæ*.)

(3938.) In the *Cleomidæ* the fruit is truly capsular, with submembranous valves, and dehiscent; the plants included are also herbs or undershrubs, with often compound leaves, and usually a glandular pubescence.

(3939.) In the *Cleomidæ*, on the contrary, which are trees or shrubs (rarely herbs) with simple or ternate leaves, the fruit is subcarnose and indehiscent.

(3940.) In general properties the *Capparidaceæ* resemble the *Brassicaceæ*, being for the most part pungent and stimulating as food, and rubefacient, anti-

scorbutic, aperient, and diuretic, when used as medicines. One important exception is however known, for a species of *Caper*, or a plant closely allied to the genus *Capparis*, is affirmed to be poisonous. Their flowers are in general specious.

(3941.) CLEOMIDÆ. Several species of *Cleome* have a hot and very pungent flavour. *C. gigantica* is really caustic, and its root tastes like the seeds of the sinapis; and *C. ornithopodioides* is even known in the Levant under the name of mustard. *C. icosandra* is used in Cochin-china as a counter-irritant, in the manner that sinapisms are employed in Europe, and it is said to produce vesications. Hamilton mentions that *C. felina*, steeped in milk and mixed with sugar, is used in India to allay epistaxis. *C. pentaphylla* is regarded as a sudorific; and the natives of Hindustan rub their bodies with its leaves, to render the cutaneous circulation more active, and hence to cure headach, and relieve deafness; and *C. viscosa* is also used for the latter purpose, being introduced into the ears. In St. Domingo *C. triphylla* is esteemed as an antiscorbutic, and *C. icosandra* and *C. pentaphylla* are both eaten as salad herbs. A species of *Cleome*, growing in Guadaloupe, and called, in the Journal de Pharmacie, *C. sinapistrum*, is said to produce vesications when applied to the skin. *C. Droserifolia* has hairy glandular leaves, resembling those of the common sundews. The genus *Cleome*, which has sometimes four, and sometimes six unequal stamens, has been placed by some systematists in the Linnean class Tetradynamia.

(3942.) *Polanisia* (olim *Cleome*) *graveolens*, is employed as a vermifuge in the United States of America.

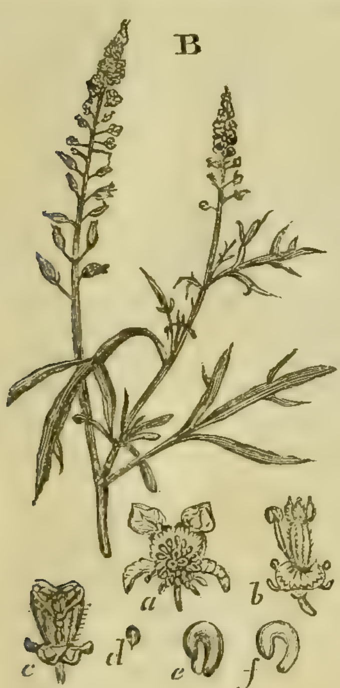
(3943.) Physostemon is a remarkable genus, for in it the stamina are 6 or 8 in number, 2 or 4 of which are shorter than the remainder; so that, like *Cleome*, the flowers become in some measure subtetradynamous, and establish still more closely the relationship between this type and the preceding. These plants are also curious, from the inflation of their filaments just below the anthers.

(3944.) CAPPARIDÆ. *Cratæva religiosa* is the *Pura-au* or *Pura-ta-rura* of Tahiti; it is there planted in the burial-grounds, and is supposed to be held sacred to their idols by the natives. Its leaves are aromatic and stimulant, and have been used as stomachics and diuretics. The bark of *C. Tapia* is bitter and tonic, and by the Indian practitioners is esteemed as such, and used in the cure of intermittent fevers: it has a baccate fruit as large as an orange, but its strong smell of garlic renders it unpalatable; and this is said to be even communicated to the animals that feed on it. This peculiar alliaceous odour is common to the fruits of all, or most of the species, which hence have been called garlic pears. The juices of *C. gynandra* are said to be so acrid that they will produce vesications like cantharides.

(3945.) *Capparis spinosa*, the common caper, is well known from the agreeable condiment which its pickled flower-buds afford. It is cultivated on a great scale in the South of France and Italy, and when pickled exported in large quantities. Its chief consumption in this country is as an ingredient in sauces—to be eaten with boiled meats, especially mutton. Capers are esteemed antiscorbutic, and the leaves as well as the buds and fruit of several species, such as *C. Ægyptiaca, spinosa,* and *rupestris*, have been used medicinally. *C. ferruginea* is the *Bois caca* of the Antilles, so called by the French colonists, on account of the fœtor of its flowers, which, when expanding, smell like ordure.

(3946.) Resedaceæ. *Reseda* and *Ochradenus*, which, together, form this small type, are herbaceous, rarely suffruticose plants, with aqueous juices, simple alternate leaves, minutely papillose on their surface, and biglandulose at their base, but destitute of true stipules. The inflorescence is terminal and racemose, the pedicels furnished with bracteolæ, and the flowers irregular and united.

The calyx is free, herbaceous, and persistent, formed of 4-5-6 connate sepals, which are unequally cleft; and open, or subimbricate in æstivation. The torus is short and stipitiform, ending in a fleshy disk, which is situated between the petals and the stamens. The corolla is formed of 4-5-6 petals, which alternate with the sepals in their exsertion, and like them are open in æstivation. They are



B. *Reseda lutea*.

(*a*) A flower isolated.

(*b*) Ditto, the petals and most of the stamens being removed.

(*c*) Section of the fruit, to shew the parietal placentæ.

(*d*) A seed.

(*e*) Section of ditto enlarged.

(*f*) Embryo isolated.

usually fringed or cleft, furnished with broad claws, and exserted from the base of the disk; the anterior largest, and the posterior smaller or abortive, and sometimes altogether absent, as in Ochradenus, or rather degenerate, and their vestiges remaining in the form of an annular extension of the disk. The stamens are definite (10-20), hypogynous, and uncovered in æstivation. The filaments are free and erect, the anthers 2-celled, at first erect, afterwards incumbent, and extrorsely dehiscent longitudinally by chinks, and without any obvious connectivum. The germen is 3 or 4 angled and pedicelled, open at its apex, 1-celled, with 3-6 parietal nerviform many-ovuled placentæ, styles none, stigmata sessile, distinct, alternating with the trophosperms, and persistent.

The fruit is capsular in *Reseda*, baccate in *Ochradenus*. The capsules are membranous, open at the top, 3 or 4 angled, inflated, with the placentæ equal in number to the stigmata, parietal, and many-seeded. The seeds are kidney-shaped, sessile, pendulous, arranged in double alternate series, or scattered by abortion; in colour white or yellowish brown, exarillate, and exalbuminous. The hilum is

small and oblique, the testa crustaceous and dotted, the embryo curved, with a thick cylindrical blunt superior radicle, and semi-cylindrical cotyledons.

(3947.) Hence, differentially considered, the *Resedaceæ* are non-lactescent *Rhæadinæ*, with laciniate or abortive petals, open æstivation of calyx and corolla, a 1-celled open fruit with 3 parietal polyspermous placentæ, and exalbuminous reniform seeds, with curved embryos.

(3948.) The immediate affinities of the *Resedaceæ* are evidently with the *Papaveraceæ* and *Capparidaceæ* on the one hand, and with the *Polygalaceæ* on the other. They are also connected with the *Ranunculaceæ*, and more distantly with the *Tropæolaceæ* through the *Cruciferæ;* an affinity which is further corroborated by the approach of the *Polygalaceæ* to the *Balsaminaceæ*. The unclosed capsules of *Reseda*, and the apetalous flowers of *Ochradenus*, shew a peculiar resemblance to *Datisca* of the *Urticinæ* [§ 1652], but the speculation of their close alliance with the *Euphorbiaceæ* has been shewn, and acknowledged to be erroneous.

(3949.) The *Resedas* were used by the Romans as poultices to allay irritation, and, from their supposed influence in assuaging pain, their common generic designation has been derived. *R. luteola* is the dyer's weld, which was formerly in great esteem for imparting a beautiful yellow colour to cotton, linen, silk, and woollen goods. Blue cloths dipped in this dye-stuff become green; and it is from the weld that the yellow pigment called Dutch pink is made. This is one of the first plants which grows on the heaps of rubbish that are thrown out of coal-pits. Linneus observed that the nodding spikes of *R. luteola* follow the course of the sun in their nutation, even when the day is cloudy, pointing eastward in the morning, south at noon, towards the west at sunset, and due north at night.

(3950.) *Reseda odorata* is the mignionette, one of our most cherished and deservedly favorite domestic plants. It has not been introduced into this country more than three quarters of a century, but it quickly established itself in universal favor, and has been for some years cultivated most extensively in the environs of the metropolis; and, from the abundance in which it is supplied to the inhabitants of London, the streets are often rendered redolent with its fragrance. *R. arborescens*, the tree mignionette, is a variety which has been rendered suffruticose by preventing the early development of its blossoms. In France this variety is more encouraged than here, and instances are known in which the stems have become woody, and exceeded an inch in circumference.

(3951.) The *Resedaceæ* are innocuous plants; but, excepting the fragrance of the mignionette, and the colouring principle of the weld, they do not possess any remarkable sensible properties.

(3952.) POLYGALACEÆ. The Milkwort (*Polygala*), and its typical allies, are herbaceous or shrubby plants, with often lactescent juices, and simple entire exstipulate leaves. The inflorescence is solitary and axillary, or racemose, with tri-bracteate pedicels, and the flowers are irregular and united, often small and inconspicuous, but sometimes shewy.

The calyx is formed of 5 (rarely, as in some, Krameriæ, of 4,) sepals, often glumaceous, but sometimes petaloid, distinct, very irregular, and imbricate in æstivation; three are external, 1 of which is axial or superior, and 2 anterior, while the 3 inner ones are lateral, thus representing in arrangement the standard

wings and keel of the Papilionaceæ. The corolla is usually formed of 3, sometimes 5 hypogynous petals (rarely abortive), the anterior one being the largest; the two smaller are superior, and disposed one on each side of the axial sepal; when 5 petals are present the 2 supernumerary ones are minute, and alternate in their exsertion with the wings and keel sepals of the calyx. The petals are usually more or less connected with each other and with the staminiferous tube; rarely discrete; the keel petal is sometimes entire, when it is either naked or crested, at others 3-lobed, when the crest is always absent. The disk is sometimes absent and sometimes present, and irregular in form. The stamens are definite (4-8, rarely 5) and hypogynous in their exsertion, the filaments are combined below so as to form a tube, which is cleft above, opposite the axial sepal; hence they are usually monadelphous, but in Krameria they are distinct. The anthers are clavate, innate, for the most part 1-celled and dehiscent by terminal pores, very rarely by longitudinal chinks. The germen is superior and free, formed of 2 connate carpels, and 2-celled, the position of which cells is anterior and posterior; the axial one, that is opposite the upper sepal, is occasionally abortive; the ovules are in general solitary, and pendulous from the apex of the placentæ; sometimes, but very seldom, in pairs. The style is single, incurved, occasionally very oblique or hooded at the extremity, and deciduous; the stigma is bilabiate or simple.

The fruit is for the most part capsular, compressed, 2-celled, or rarely 1-celled by abortion, with a loculicidal dehiscence and septiferous valves, rarely indehiscent, and drupaceous or coriaceous, and winged like a samara, or wingless. The dissepiment is narrow, membranaceous, and very thin, with nerviform placentæ. The seeds are solitary, and pendulous by a very short funicle from a little below the apex of the cell, and furnished with a caruncle next the hilum, simulating an arillus. The testa or exoderm is crustaceous, and either smooth or hairy; the endoderm or tegmen is membranaceous, the raphe linear, and expanding at its extremity into a chalaza. The albumen is fleshy, usually abundant, rarely degenerating into a thin gelatinous lamina, and very seldom absent, when the endoderm is tumid. The embryo is of the same length as the albumen, axile, flat, straight or very slightly curved, and the radicle superior.

(3953.) Hence, selecting the chief differential characters, the *Polygalaceæ* are sublactescent *Rhæadinæ*, with irregular flowers, simulating those of the Papilionaceæ, but with the fifth sepal axial, and the odd petal distant from the axis; mostly catapetalous corollæ and monadelphous stamens, 2-celled fruit with axial and abaxial carpels, definite pendulous ovules, and solitary seeds, generally furnished with albumen, and caruncalate.

(3954.) The structure of the flowers in the *Polygalaceæ* is very remarkable; their general resemblance to the Papilionaceæ is striking, but in them the calyx rather than the corolla is butterfly-shaped, and the relative position of the fifth sepal and petal are reversed. The degeneration and frequent suppression of the lateral petals will account for the abortion of the fifth stamen, as in Krameria, when 4 only (and sometimes but 3) are developed, and for the fifth being absent in the two series when there are 8, which is the common number. The irregularity of the flowers, and even the disposition of their parts, connect them with the *Fumariaceæ* and the *Resedaceæ* rather than with the *Droseraceæ* and *Violaceæ*, to which they are approximated by De Candolle, and their caruncalate seeds

establish their relation with the Tremandraceæ, which immediately follow: their similitude to the Leguminosæ is one of analogy rather than affinity, and is sufficiently indicated by the apposition of the two groups in the ascending and descending scales.

(3955.) The *Polygalaceæ* are mostly ornamental plants, and some are possessed of considerable beauty. Their leaves have a bitter astringent taste, and the roots, which frequently exude a cream-like juice, have similar properties, but in a higher degree, and blended with more or less acridity; with one exception, they seem to be innocuous, but their properties have not as yet been sufficiently investigated.

(3956.) The *Polygalæ* have received their name of milkworts, from the influence some of the European species are supposed to possess over the lacteal secretion of cattle fed upon them, and, as they are stomachic and stimulant, it is not improbable the opinion is well founded. *P. amara* and *vulgaris* are much relished by cows, sheep, and goats, but swine reject them as fodder. *P. Senega* is employed in medicine, and its root is esteemed a powerful expectorant, and also a stimulating tonic. It is said likewise to promote the excretion both of the skin and kidneys, as well as of other mucous membranes, and hence to have afforded marked relief in cases of peripneumonia notha and asthma; and, as an auxiliary, even in croup. It was once celebrated as an antidote for the bites of poisonous reptiles; but its use in such accidents is now obsolete. *P. amara* and *P. vulgaris*, both natives of Europe, possess properties similar to those of the *P. Senega*, but in a less degree, and they have been found serviceable in cases of chronic catarrh. In large doses both the powder and decoction of the roots produce vomiting. *P. glandulosa* is the *Yan-foo* of the Chinese, often called black ipecacuan, on account of its emetic powers; and *P. Pooya*, a native of Brazil, is said by Martins to be used there for the same purpose. *P. rubella* is reported by Bigelow to be an excellent bitter: it is employed in the United States of America as a stimulating tonic, and in large doses as a diaphoretic. *P. Chamæbuxus* and *P. sanguinea* possess similar properties to *P. Senega*, and might be used as substitutes for it. *P. tinctoria*, which is found in Arabia, is said by Forskal to afford a kind of indigo; and its seeds are also used by the Arabs to dislodge the tape worm. *P. venenata*, a native of Java, is remarkable for the poisonous properties attributed to it. Commerson says that when he touched a leaf of this plant with the end of one of his fingers, he was seized with long and violent sneezing, and an oppressive faintness. His guide, he continues, cautiously avoided coming in contact with it; and that it is much dreaded by the Javanese for its malevolence.

(3957.) Two peculiar principles have been separated from the roots of the senega, one by Gehlen, which he called *Senegine*, and the other by Reschier, called by him *Polygaline;* this latter is said to be combined with a peculiar acid named the *Polygalinique*, and to be the essentially active ingredient; the other is reported to be a powerful sternutory: but further observations on the analysis of this root are required.

(3958.) *Monnina polystachya* is the *Yal-hoe* of Peru, where it is much commended in the treatment of dysentery. *M. pterocarpa* is also used for the same purpose, and *M. salicifolia* is greatly valued for its cleansing powers: the Peruvian ladies employ it in infusion to wash their heads, and attribute the beauty of their

tresses to its detersive powers. The silversmiths at Huanco likewise use it to clean and polish their silver ornaments. This genus is one of those which have indehiscent fruits; the others are *Mundia*, *Securidaca*, and *Krameria*.

(3959.) *Krameria* deviates more than any other genus in this very natural group from the normal structure of its compeers. Its sepals are generally 4, rarely 5. The stamens 4 or 3, and discrete, or but slightly connate by their filaments. The fruit is indehiscent, and by abortion 1-celled or incompletely 2-celled, and the seeds are destitute of albumen.

(3960.) *K. triandra* is the rhatany, which is a valuable astringent tonic. It has proved serviceable in diarrhœas, and other fluxes of debility. Its extract very much resembles kino. It has been used in large quantities to colour wines; and some persons would attribute the medicinal properties of port in some measure to the rhatany it contains. We accuse the Continental vintners with making their wines tinctures of rhatany, and they accuse us of using the drug to give a colour to our home-made imitations. Its spirituous tincture nearly resembles port wine in flavour. *K. Ixina*, the rhatany of the Antilles, appears to possess similar properties to that of Peru. Equal parts of powdered rhatany, charcoal, and orris-root, make one of the best dentifrices known.

(3961.) TREMANDRACEÆ. *Tremandra* and *Tetratheca*, which form this small type, with which the section *Rhœadinæ* closes, are slender shrubs, often covered with glandular pubescence, and resembling heaths. Their leaves are alternate, rarely opposite or whorled, mostly simple, and always exstipulate. The inflorescence is axillary and solitary, and the flowers regular and united.

The calyx is free, formed of 4-5 equal sepals, subcoalescent at the base, valvate in æstivation, and deciduous. The torus is obsolete. The petals equal in number to the sepals, and alternate with them, regular in size and form, shortly unguiculate, deciduous, involute in æstivation, much larger than the sepals, and enclosing the stamens. The stamens are free, hypogynous, definite, uniseriate, 2 before each petal; hence 8 or 10 in number. The filaments are erect, the anthers innate, 2-4-celled, and dehiscent by terminal pores or tubes. The germen is superior, ovate, or compressed, and 2-celled, each cell containing 1-3 pendulous ovules; the style single, cylindrical, filiform, and straight, and the stigmata 1-2, *i. e.* simple or cleft.

The fruit is an ovate, compressed, 2-celled, 2-valved capsule, with a loculicidal dehiscence, the valves bearing the dissepiments on their median lines. The seeds are pendulous from the upper part of the placentæ, ovate, without any appendage near the hilum, but furnished with a caruncle at the apex. The albumen is fleshy, the embryo cylindrical, straight, and axial, longer than the albumen, with the radicle superior.

(3962.) Differentially considered, the *Tremandraceæ* will hence appear to be fruticose *Rhœadinæ*, with regular flowers, valvate sepals, and involute petals, 8-10 discrete stamina, the anthers of which open by terminal pores, a 2-celled 1-2-seeded capsule, and pendulous albuminous seeds.

(3963.) Of the properties of these plants there is nothing at present known with certainty. Only seven species of the first genus and two of the second have been as yet described. They are all natives of New Holland, and probably many, as yet undiscovered, will reward the researches of future travellers.

Their carunculate seeds and definite pendulous ovules approach them to *Polyga-*

laceæ. De Candolle also hints at their relationship with the Droseraceæ; but that is more distant. They are well characterized by their seeds, the æstivation of their flowers, and the dehiscence of their anthers.

RUTINÆ.

(3964.) This section includes five very natural types or groups of genera, which, besides their primary relationship with each other, exhibit numerous and scarcely secondary connexions with the *Terebinthinæ* of the *Myrtosæ*, already described. Indeed, these two sections, although systematically belonging to different suborders, are so similar in many points of structure—in the principles they elaborate, and in the properties they possess, that several authorities have arranged them side by side, or even blended them together, notwithstanding the perigynous exsertion of the stamens in the one, and their hypogynous exsertion in the other. This departure from the principles of the Jussieuan scheme does not, however, seem to be more necessary here than in other parallel cases, such as the *Dianthinæ* and *Crassulinæ*, the *Myrtinæ*, and *Camellianæ*, &c. And the resemblance is perhaps sufficiently regarded when viewed principally as one of analogy, and at least more conveniently indicated by the apposition of the two groups in the two parallel suborders, than by combining them together, or arranging them immediately in succession. [Vide § 1967.]

(3965.) *Ochna*, *Ruta*, *Aurantium*, *Olax*, and *Amyris*, are the plants which give their names to the five types this section comprehends, and from the rue, which may be considered the normal genus, is derived their collective name, RUTINÆ.

(3966.) The *Rutinæ*, collectively considered, are balsamic or resiniferous *Rhœadosæ*, with mostly exstipulate punctate leaves, imbricate sepals, definite stamens, and the layers of the pericarp separating, or easily separable, from each other.

(3967.) AMYRIDACEÆ. *Amyris*, distinguished from its ancient allies, the *Burseraceæ* [§ 2002—2015], on account, amongst other characters, of the hypogynous exsertion of the stamens and punctate leaves, forms, with *Pachylobus*, the present type.

(3968.) The *Amyridaceæ* are trees or shrubs, abounding in resin, with opposite, exstipulate, compound leaves, studded with pellucid dots, which are reservoirs of essential oil.

The inflorescence is in axillary or terminal panicles, and the flowers are small, regular, and united.

The calyx is small, regular, formed of 4 connate sepals, and persistent. The petals are 4, hypogynous, discrete, and imbricate in æstivation. The stamens are definite (8), twice the number of the petals, and hypogynous in their exsertion. The filaments are free, and the anthers dehiscent lengthwise by chinks. The disk is thick, and bears the germen, which is superior, 1-celled, and 2-ovuled. The ovules are pendulous, the style absent, and the stigmata sessile and capitate.

The fruit is subdrupaceous, indehiscent, monospermous, and the pericarp is covered with granular glands or small dot-like receptacles, filled with balsam or aromatic oil. The seed is exalbuminous, the cotyledons fleshy, and the radicle superior and very short.

(3969.) Hence, differentially considered, the *Amyridaceæ* are subdrupaceous *Rutinæ*, with opposite, compound, exstipulate dotted leaves, quaternary flowers, distinct simple carpels, and solitary exalbuminous seeds.

(3970.) The *Amyridaceæ* are fragrant resiniferous plants, highly stimulating and antispasmodic, and in general innocuous; but one species, *Amyris toxifera*, is reported to be poisonous.

(3971.) Gum elemi is procured from a species of Amyris called by Linneus *A. Elemifera*, and by De Candolle *A. Plumieri*, but it does not seem certain that their references are to the same plant, and not improbably elemi may be yielded by several species: an inferior kind is known to be afforded by *A. hexandra*, and a resin with a disagreeable odour substituted for it comes from *A. sylvatica*. Elemi forms an ingredient in various digestive ointments and discutient plasters; it has also been used internally as a substitute for copaiba.

(3972.) *A. toxifera* is the Janca, or white candle-wood, of Carolina; a black juice distils from the trunk of this tree, which is said to be very poisonous. The berries resemble copaiba balsam both in smell and taste. An infusion of the leaves, which has a pleasant flavour, is said to relieve headach. Its timber is valuable, as it bears a high polish.

(3973.) The liber of *Amyris papyrifera* is separable into thin layers, which are used as tablets by the Nubian Mahommedans to inscribe their legends upon. Bdellium is supposed to be the produce of a species of *Amyris*. Many plants once considered *Amyrides* are now referred to the genera *Icica* and *Bursera*; and the most important of these have been already noticed. [§ 2002, et seq.]

(3974.) *Pachylobus edulis* is a native of the Island of St. Thomas, in the Gulf of Guinea, where its fruit is sold in the market of St. Ann de Chaves under the name of *Safu*. The fruit, called Pascoe, is said by Don to be the produce of another species, but very little is known of either. Their taste is bitter and astringent, and they are usually roasted before they are eaten.

(3975.) Olacaceæ. *Olax*, and its typical allies, are arborescent plants, with alternate, simple, entire, petiolate leaves; sometimes the foliage is abortive, and the stipules are always absent.

The inflorescence is axillary, and the flowers small, unsymmetrical, and united, or by abortion polygamous.

The calyx is small, free, synsepalous, entire, or slightly toothed, and often becoming enlarged or fleshy. The torus is obsolete. The corolla is formed of 4-6 hypogynous subcoriaceous petals, which are either wholly discrete or connected in pairs through the intervention of the filaments, and valvate in æstivation. The stamina are definite, part being sterile in the form of hair-like nectaries, either simple or cleft, opposite and attached to the petals, while part (3-10) are fertile, hypogynous, alternate with the petals, and coherent with them by the filaments and ungues. The filaments are compressed and awl-shaped, the anthers cordate, oblong, innate, 2-celled, and dehiscent longitudinally. The germen is free, 1-celled, with 3 ovules suspended from the top of a central placenta, or 4-celled, with the cells uniovulate: the style 1, filiform, and the stigmata 3-4, and simple or subdistinct.

The fruit is subdrupaceous, indehiscent, and often invested by the persistent fleshy calyx (or involucrum ?), 1-celled, and by abortion 1-seeded. The seed pendulous, and umbilicate at the base. The albumen large and fleshy, the embryo

small, ovate, basilar, enclosed within the albumen, and the radicle, which is continuous with the cotyledons, directed towards the hilum.

(3976.) Hence the *Olacaceæ*, differentially considered, are exstipulate *Rutinæ*, with unsymmetrical flowers, nectariferous petals, definite stamens, concrete carpella, 1-celled ovary, with central placentæ, and solitary pendulous albuminous seeds.

(3977.) The nature of the organ above described as a calyx is questioned by some botanists, who think it may be rather an involucrum; and, if such be the case, these plants should be referred to the monochlamydeous *Querneales*, and they have, by Dr. Brown, been approximated to the *Santalaceæ* [§ 1706] of the *Laurinæ*, and by others to the *Aqualariaceæ* [§ 1581], and even to the *Samydaceæ* [§ 3292] of the *Ulminæ* and *Grossulinæ*. Jussieu, who regarded the slight union of the parts of the corolla as rendering them monopetalous, referred them to the neighbourhood of Sapota; and Bartling declined locating them at all: their place in the natural system must therefore be considered as at present undetermined; for although, following De Candolle, they are here approximated to the *Aurantiaceæ*, with which they have many characters in common, further observations may discover other and more intimate relations.

(3978.) Of the properties of these plants there is very little known; some are esculent, and all, as far as experience goes, innocuous. *Olax Zeylanica* is used in Ceylon as a potherb, and also as a salad; it is there called Mœla-hola, which signifies salad-tree, whence its generic name, which is more probably a corruption of *hola* than a misapplication of ολαξ.

(3979.) The fruit of *Ximenia Americana* is eatable; it is about the size of a pigeon's egg, of a yellow colour, and has a sweetish subacid flavour. *Heistera coccinea* is the 'bois perdrix' of the French colonists in Martinique, and it affords the partridge-wood of the cabinet-makers.

(3980.) *Icacina Senegalensis*, a plant allied to the *Olacaceæ*, but scarcely belonging absolutely to the type, seems by its habit and glandular disk to connect them with the *Aurantiaceæ*. It is a thorny shrub, with much the appearance of a citrus, especially *C. Limonum*. Its fruit is yellow, and has a pleasant flavour, which has been likened to that of noyeau.

(3981.) Aurantiaceæ. The Orange, and its typical associates, are trees or shrubs, with almost always smooth stems and branches, a few of the buds being occasionally converted into spines. The leaves are dotted, alternate, often compound, the lamina commonly articulated with the petiole, which is frequently dilated or winged, but destitute of stipules. Their juices are balsamic, and they are covered, both leaves, flowers, and fruit, with receptacles of essential oil. The inflorescence is variable, the flowers regular and united, white, red, or yellow, and very fragrant.

The calyx is free, short, urceolate or campanulate, 4-5, rarely 3-toothed, adhering to the disk, and marcescent. The torus is disk-like or stipitiform, and subadnate to the bottom of the calyx. The petals 3-5, exserted from the torus, equal in number to the divisions of the calyx, and alternate with them, broadest at the base, either discrete or subconnate, deciduous, and slightly imbricate in æstivation. The stamens are equal in number to the petals, or some multiple of that number, being 2-3 or 4 times as many, exserted from the torus, and uniseriate. The filaments are flattened at the base, sometimes discrete, sometimes connate in

one or more fasciculi. The anthers are terminal and innate, 2-celled, dehiscent lengthwise by chinks, with a jointed filament, and often glandular towards the summit. The germen is superior, formed of several connate carpels and central placentæ. The style is taper, and the stigma thick and slightly lobed.

B

Citrus Aurantium.

B. Cutting, to shew the winged articulate leaves and flowers.

(*a*) Flower deprived of petals, to shew calyx and stamens.

(*b*) Pistil.

(*c*) Section of fruit, to shew its many concrete carpels.

The fruit is indehiscent, either dry or juicy, with a coriaceous exocarp, destitute of valves and beset with glands, and easily separable from the endocarp, which is membranous, and forms the dissepiments. The cells are as many as the carpels, arranged round an imaginary axis, sometimes filled with a juicy pulp, and sometimes void. The seeds are numerous or solitary, affixed to the inner angles of the carpels, usually pendulous, and often enclosing many embryos. The albumen is absent, the raphe strongly marked, and the chalaza well developed and cup-shaped. The embryos are straight, with a retracted superior centripetal radicle turned towards the hilum, and large thick cotyledons, which are auricled at the base, and a conspicuous plumula.

(3982.) The *Aurantiaceæ* are hence, differentially considered, exstipulate glabrous *Rutinæ*, with mostly compound dotted leaves, symmetrical flowers, exunguiculate petals, concrete carpella, a many-celled indehiscent fruit, and exalbuminous chalazous seeds.

(3983.) The *Aurantiaceæ* are without exception innocuous plants, much esteemed for their fragrant flowers and wholesome delicious fruits. The orange, the lemon, the citron, the shaddock, and the lime, are familiar examples; for, although originally tropical rarities, they are now grown in the temperate latitudes, and imported into this country in such abundance as to vie in plenty and cheapness with our native fruits.

(3984.) The orange has been by some classical commentators believed to be

the golden apple of the Hesperides, and hence the fruit, which differs essentially from a berry, has been called *Hesperidium:* one of the genera associated with it has also been named *Atalantia;* another *Ægle;* and another, from its beauty, *Aglaia.*

(3985.) The fruit of *Atalantia monophylla,* which is the Hindu wild lime, of *Triphosia trifoliata, Glycosmis-pentaphylla,* and the different species of *Ægle* and *Aglaia,* are all eatable and pleasant. *Æ. Marmelos* is said to be very delicious to the taste, and exquisitely fragrant. It is also highly nutritious, containing a large quantity of tenacious transparent gluten, which, when fresh, may be drawn out into fine threads two or three yards long, like macaroni; a decoction of its root is said to be an effectual cure for hypochondriasis, and its leaves to be serviceable in asthma. Roxburgh adds, that the viscid matter is sometimes used as a cement. The Dutch prepare a delightful perfume from its bark in Ceylon, where it is a native: and *A. odorata,* the flowers of which are very fragrant, are said to be used by the Chinese to scent their teas.

(3986.) *Feronia Elephantum* is the elephant apple of the Coromandel Coast, where it is universally eaten; and a transparent oily fluid, that exudes from its trunk when wounded, is used by painters for mixing their colours; it also yields a gum resembling gum arabic. Its wood is white, hard, and durable. Its young leaves, when bruised, smell like anise, and are esteemed in India as stomachic.

(3987.) The fruit of *Bergera Koenigii* is about the size of a pigeon's egg, and has something the flavour of European white currants; it is much prized and sought after as a dessert in India. Its green leaves are administered by the Hindu practitioners in a raw state to relieve dysentery; and, when roasted, to allay vomiting. They are said to be tonic and stomachic; and the bark and root in decoction are used medicinally as stimulants.

(3988.) *Murraya exotica,* and *paniculata,* have both odoriferous flowers; the latter smell like jasmine, and its fruit tastes like gooseberries. *Cookia punctata, falcata,* and *cyanocarpa,* natives of China, Cochin-china, the Moluccas, and Japan, commemorate our enterprising circumnavigator, Captain James Cook: their fruit is called *Wampu* in China; it is sweet but slightly acrid, and is met with in abundance in the markets at Canton.

(3989.) *Limonia,* a genus very closely allied to *Triphosia* and *Glycosmis,* has been so called from *Lymoun,* which is the Arabic name of the citron. The fruit of *L. citrifolia* is said to be delicious; and the fruits of other species, with that of *T. trifoliata,* are commonly known as orangines, and are thought by some persons to be the real China oranges. They are most exquisite when candied. *L. acidissima* is very sour, and its pulp, which is detergent, is employed in Java as a substitute for soap.

(3990.) But, notwithstanding the many fragrant flowers and delicious fruits afforded by this group, they are all exceeded by the several species and numerous varieties of the genus Citrus, which includes the orange, the lemon, the citron, the shaddock, and the lime.

(3991.) *Citrus Medica,* is the *Malus Medica* of the ancients, so called from Media, whence it was introduced into Italy. The lemons were formerly included under this term; it is however at present restrained to the Citron, at one time called *C. M. Cedra.* There are three chief varieties of this fruit: the common citron of Nice, the tuberculated citron, and the citron of Florence. The rind in

all these varieties, especially in the warted or monstrous one, is very thick, and, when candied with sugar, forms an excellent sweetmeat.

(3994.) *Citrus Limetta* is the lime, of which there are 7 or 8 varieties, such as the sweet limes, the star, the bergamot, the pear, and the rose limes, with the Adam's apple, and the Lumy; they are all agreeable fruits, varying in their sweetness and acidity.

(3995.) *Citrus Limonum* is the lemon, of which numerous varieties occur: these are chiefly distinguished by their size and form, and in catalogues they are in general classed into 1°, egg-shaped lemons, with blunt nipples; and 2°, oblong lemons, with large nipples; to which must be added, the monstrous *fingered lemon,* the *Phat-thu* of the Chinese, in which the carpels are more or less separated from each other, and covered all round with the common rind. The fruit is solid, without any cells or pulp, and the clefts something resemble the fingers of a distorted hand. The most valued kinds of the first variety are the common *thin-rinded* lemons, the *Naples,* the *Nice,* the *incomparable,* the *Poncine,* and the *sweet lemon;* and of the second, the *imperial,* the *Gaeta,* the *wax,* and the *long-fruited.*

(3996.) *C. Paradisi* is the Paradise apple, or Forbidden fruit. It is very large, often as big as a child's head, of a pleasant subacid flavour, but much less grateful than the orange.

(3997.) *Citrus Aurantium* is the *orange* or *golden apple,* its specific name being a derivative of *Aurum,* and alluding to its rich reddish yellow hue. *C. Aurantium* is the sweet orange, too well known to need description, and too much esteemed to admit of praise. Its varieties, like those of most cultivated fruits, are many. The most important are 1°, the *common sweet orange;* 2°, the *China;* 3°, the *Majorca;* 4°, the *Nice;* 5°, the *Genoa;* 6°, the thick-rinded *Portugal;* 7°, the *teat-fruited;* 8°, the *double-flowered;* 9°, the *ribbed;* 10°, *Malta,* or *blood-juiced;* 11°, the *St. Michael's;* and 12°, the *Oporto,* or pipless pot oranges.

(3998.) *Citrus vulgaris* is the bitter or Seville orange, of which, like the preceding, there are several varieties, but they are less cultivated, as, although preferable in medicine, they are less palatable as food.

(3999.) *Citrus decumana* is the *Shaddock,* so called after the captain who first introduced it into the West Indies from China. It is a large handsome fruit, but not so pleasant in its flavour as the orange; it will however keep fresh and good longer at sea, and hence is valuable. There are several other species of *Citrus* whose fruits form pleasant food, such as the *C. nobilis,* both the rind and pulp of which are eatable. This latter is called in China the *Mandarine,* and is considered the most delicate of the whole.

(4000.) The *Aurantiaceæ* contain sugar, acid, and a bitter principle, with an aromatic essential oil, varying in the different species of orange, lemon, &c., and giving to them their peculiar flavors. The acids are the citric and malic, and these occur in most abundance in the lemons. In the oranges (*Aurantia*) the acidity is less developed, and the saccharine principle prevails; while in the Seville oranges the bitter matter is predominant. Hence the first are chiefly employed in medicine as febrifuges, or in the manufacture of cooling drinks; the second as a dessert, and the third as a stomachic. From the rinds of different varieties are procured the essential oils of lemon and bergamot; from the flowers, an aromatic water is distilled and a fragrant oil procured; and the unripe or abortive fruits, called

Curaçoa oranges, or orange peas, are used, the former to flavor the delicious liqueur called curaçoa, and the latter to keep issues open, for which, on account of their fragrance, they are well adapted.

Between 2 and 3 hundred millions of oranges and lemons are annually imported into this country, which yield to the revenue about 53,184*l.* per annum.

(4001.) RUTACEÆ. The genera associated to form this type are trees, shrubs, or herbaceous plants, with opposite or alternate leaves, stipulate or exstipulate, and for the most part punctate. The inflorescence is variable, either axillary or terminal, and solitary or aggregate; the flowers regular or irregular, and in general united, though occasionally separate by abortion.

The calyx is formed of 3-5 sepals, connected at their bases, and imbricate (very rarely valvate) in æstivation. The corolla is formed of 5 petals, discrete or connate, very seldom abortive. The stamens are definite 5-10, some of which are occasionally abortive, constituting a variable nectary. The disk is sometimes dilated, and sometimes absent. The germen is formed of 3-5 carpels, discrete, or more or less intimately conjoined. The cells usually 2-ovuled, rarely with 1 or many ovules. The styles free or connate, and the stigmata simple or dilated.

The fruit is sometimes capsular, the carpels being placed upon a more or less projecting disk, and forming by their union a gynobasic ovary, from the centre and base of which the style appears to be exserted; the valves of the capsule are equal in number to the styles, and bear a dissepiment on the middle of each, the dehiscence being loculicidal. Most frequently, however, the carpels are separate or separable, each being 2-valved, and sometimes drupaceous and indehiscent. The mesocarp is thin, or sometimes slightly fleshy; the endocarp thin or woody, and opening by two incomplete valves. The seeds are, from abortion, less in number than the ovules, with usually a crustaceous, sometimes a membranous testa. The albumen (rarely absent) is fleshy or cartilaginous. The embryo white or greenish, with a straight superior radicle, very seldom oblique, and turned towards the hilum. The cotyledons are variable in form.

(4002.) Hence, collectively and differentially considered, the *Rutaceæ* are *Rutinæ*, with in general resinously dotted leaves, the petals occasionally concrete; the stamens definite, hypogynous, or subperigynous, the carpels free or connate, with gynobasic styles, and mostly two seeds, which are pendulous, the embryo straight, and the radicle superior.

(4003.) The genera included in this type, although closely connected to each other, are in many points so various that they have been divided into 4 or 5 distinct families or orders. It seems however preferable to keep them united, as is done by Richard and Adrien de Jussieu, and to consider their subordinate discrepancies as indicative merely of subtypes and districts. Hence the *Rutaceæ* may be distinguished into 3 subtypes, which, from *Zygophyllum*, *Ruta*, and *Simaruba*, are called the *Zygophyllidæ*, *Rutidæ*, and *Simarubidæ*.

(4004.) In the *Zygophyllidæ* the leaves are opposite (or alternate,) furnished with stipules, but destitute of pellucid dots. The carpels connate, the capsules dehiscent from the superior angles, not elastic like coccules; the seeds many, rarely solitary, the albumen cartilaginous, (absent only in *Tribulus*,) and the cotyledons leafy.

(4005.) In the *Rutidæ* the leaves are variable in form, but covered with pel-

lucid dots, and exstipulate;* the carpels are often distinct, and with an elastic dehiscence like cocca. The stamina occasionally sub-perigynous, and the seeds inverted, the albumen fleshy, seldom absent, and the cotyledons foliaceous.

(4006.) In the *Simarubidæ* the leaves are alternate, impunctate, and exstipulate; the carpels discrete, drupaceous, and indehiscent, 2-valved, and 1-seeded. The seeds pendulous and exalbuminous, the cotyledons thick, and the radicle short and retracted.

(4007.) *Zygophyllidæ.* Some of the *Zygophyllidæ* have opposite, and others alternate leaves; the former have been termed *Zygophylleæ veræ*, and the other *Z. spuriæ*, or *Chitonieæ*.

(4008.) *Zygophylleæ.* The different species of *Guaiacum*, especially *G. sanctum* and *officinale*, are slightly acrid bitter plants, more remarkable, however, for their stimulating properties, and much esteemed as diaphoretics and alteratives. In cachectic habits, and particularly after long courses of mercury, a decoction of the raspings of the wood, either alone or in combination with sarsaparilla and sassafras, has been found very beneficial. A peculiar resinoid substance is yielded by these trees, which has been called *Guaicine*. It is a stimulating diaphoretic, and has proved serviceable in cases of chronic rheumatism. The *Zygophyllidæ* are remarkable for the hardness of their wood; that of *G. officinale* is known in commerce as *Lignum vitæ*, and is much used in turnery for ornamental purposes; and the timber of *G. arboreum* becomes so hard, especially when buried, that the natives of Cumana believe it becomes converted into stone. Professor Voight has observed, that the direction of the woody fibres in *G. officinale* is peculiar, each succeeding layer crossing the inner one diagonally. *Porliera hygrometrica* is said to be possessed of properties similar to the *Guaiacums*.

(4009.) *Zygophyllum Fabago*, the bean-caper, is esteemed in Syria as a vermifuge; and the bruised leaves of *Z. simplex*, which is called *Carmal* by the Arabs, are, when bruised and steeped in water, stated to have the power of removing specks from the eyes, and dissipating opacity of the cornea.

(4010.) *Chitonieæ.* These plants differ from the *Zygophylleæ* in having alternate leaves. Their properties are very little known. *Melianthus* is a curious plant, the flowers of which secrete a honey-like fluid in such great abundance that the Hottentots collect and suck them, esteeming the juice, which is refreshing, a strengthening and cordial drink. The leaves have an offensive smell resembling stramoniu .

(4011.) *Rutidæ.* The genera included in this subtype are distributable into three smaller groups or districts, called, from *Ruta*, *Diosma*, and *Zanthoxylum*, the *Ruteæ*, *Diosmeæ*, and *Zanthoxyleæ*.

(4012.) In the *Ruteæ* the flowers are regular, the stamens hypogynous, the fruit capsular, and the endocarp not separating from the mesocarp.

(4013.) In the *Diosmeæ* the flowers are regular or irregular, the stamens hypogynous or perigynous, and the carpels elastically dehiscent, the layers of the pericarp separating spontaneously.

(4014.) In the *Zanthoxyleæ* the flowers are regular but separated, the stamens hypogynous, and the carpels discrete or connate, and 2-ovuled.

* *Peganum*, in which the leaves are impunctate and stipulate, is a transitional genus approaching the *Zygophyllidæ*, and perhaps should be referred to that subtype.

(4015.) *Ruteæ.* The rue, and its allies, are bitter stimulating plants, with a strong but rather unpleasant smell, and a hot bitter taste. *R. graveolens* is indeed so acrid that the bruised leaves will excoriate the lips and nostrils, and inflame the skin if applied as cataplasms. Rue was much esteemed in ancient medicine. Hippocrates commends it: for many ages it was considered a preventive of contagion, and called the *herb of grace;* and in later times Boerhaave observes, that the greatest commendations he can bestow fall short of its merits. "What medicine (says he) can be more efficacious for promoting perspiration, for the cure of hysteric passion, and of epilepsies, and for expelling poison?" But, notwithstanding all these praises, which are truly questionable, rue is now seldom employed, excepting in the form of tea, by village doctresses.

(4016.) *Diosmeæ.* This district has been subordinately distinguished into 4 or 5 minor groups, which curiously accord both in their geographical distribution and structural characters; the first being European, the second African, the third Australasian, and the fourth American.

A

Diosma uniflora.

A. Branch with leaves and flowers.

(*a*) A flower, the petals being removed to shew the perigynous stamens, perfect and rudimentary.

(*b*) Section of the flower, to shew the pistil, and an internal view of the perfect stamens, and the rudimentary ones or nectaries.

(*c*) Transverse section of the ovary to shew its cells.

(*d*) The fruit entire.

(*e*) Transverse section.

(*g*) A seed.

(*f*) Section to shew the embryo.

(4017.) The European *Diosmeæ* or *Dictamneæ* have irregular flowers, disk absent, hypogynous stamens and petals, distinct ovaries (5), and fleshy albumen.

(4018.) The African or Cape *Diosmeæ* have regular flowers, a disk adhering to the calyx, petals and stamens perigynous, the ovaries (1-5) connected, and the albumen spare or absent.

(4019.) The Australasian *Diosmeæ* or *Boronieæ* have regular flowers, hypogynous stamens, double the number of the petals, and all fertile; the disk absent, the ovaries distinct or connate, the styles conjoined, and the albumen dense.

(4020.) The American *Diosmeæ* are distinguished into the *Pilocarpeæ* and *Cusparieæ*.

(4021.) The *Pilocarpeæ* have regular flowers, petals hypogynous and free, disk surrounding the ovaries or wanting, albumen fleshy or absent, and the cotyledons large and ovate.

(4022.) The *Cusparieæ* have regular or anomalous flowers, petals 5, free or conjoined so as to resemble a labiate, infundibuliform or campanulate corolla. The disk is urceolate, the albumen absent, the embryo curved, and the cotyledons large and often corrugate.

(4023.) The *Diosmeæ* are sometimes fragrant, but in general fetid stimulating bitters; those in which the bitter principle predominates are esteemed as febrifuges, such as the Cusparia bark; and those which possess the most offensive odours are valued as antispasmodics. They are likewise commended as diuretics and anthelmintics.

(4024.) *Dictamneæ. Dictamnus Fraxinella* is the False dittany, of which there are several varieties, such as the white, the red, and the purple, common in our gardens. It secretes a fragrant essential oil in great abundance, and in warm weather this exudes and volatilizes, so that the air becomes impregnated with it, and is rendered not only very fragrant but also inflammable, so that if a candle be brought near the plant the oily vapour takes fire.

(4025.) *Diosmeæ.* The name *Diosma* is said to be a compound of διος and οσμη, a divine smell, in reference to the exquisite odour of the bruised leaves of some of the species; and it is well for the credit of the name-giver that the *Buchu,* olim *Diosma crenata,* is now transferred to another genus called *Barosma,* for the scent of its infused leaves is most disgusting. It is, however, a very useful medicine in cases of irritable bladder.

(4026.) *Boronieæ.* The leaves of *Correa alba* are said to be used in New Holland as a substitute for tea. Not any of the species of *Boronia, Crowea,* &c. included in this subdivision, have been hitherto employed as food or medicine, but their properties have not at present been sufficiently examined.

(4027.) *Pilocarpeæ. Esenbeckia* (or *Evodia*) *febrifuga,* has a very bitter bark, which is considered as efficacious as that of cinchona in the cure of intermittent fevers, and in it, or in the bark of a tree nearly related to it, cinchonine has been detected by Dr. Gomez. *Hortia Braziliana* has also a bitter bark, which is much esteemed as a febrifuge in Brazil.

(4028.) *Cusparieæ. Galipea* (or *Cusparia*) *febrifuga* affords the Angustura bark of commerce, the source of which was long a problem. As a light tonic and agreeably aromatic bitter there are few drugs superior to it. In dyspepsia it has been often found of signal service. At one time it fell into disrepute from the bark of a species of *Brucea,* hence called *false Angustura,* being mistaken for it, but which, instead of being a stomachic bitter, contains a deadly poison, named Brucine, very analogous in its properties to strychnine.

(4029.) *Ticorea febrifuga* is also esteemed in Brazil as a febrifuge, its bark being very bitter and astringent. The leaves of *T. fœtida,* which have an offensive smell, are said to have emmenagogue powers, and an infusion of those of *T. jasminiflora* are reputed to be serviceable in Frambœsia, the Yaws of the natives, and the Bobas of the Portuguese colonists.

(4030.) ZANTHOXYLIDÆ. The *Bruceæ* appear to differ very remarkably in their properties: one species, called *B. ferruginea,* or *antidysenterica,* which was discovered by the celebrated Abyssinian traveller, whom its name commemorates,

has a bitter astringent bark, and it is much valued by the natives as a remedy in dysentery and severe cases of diarrhœa, and is called by them Wooginoos; but the other, not hitherto well described, the bark of which has been frequently mistaken for the above and substituted for it, and for the Cusparia or true Angustura [§ 4028,] is poisonous. It is said to contain a principle analogous to strychnine, but less powerful, as six grains of the former are only equal in effect to 1 grain of the latter. Dr. Kinglake, in a paper published in the London Medical and Physical Journal, mentions five instances, in which, within three years, this deleterious bark had been sold by the druggists of Taunton instead of the true Angustura: in 4 of these cases, in which it was taken, most distressing effects were produced, such as universal tremors, spasmodic twitchings and faintness. In the fifth, a case of low remittent fever, death ensued. This bark is the produce of a tree, hence called, from its resemblance to the antidysenteric species, *Brucea pseudo-ferruginea;* but it is very imperfectly known, and the two are frequently confounded. The active principle of *B. pseudo-ferruginea* has been called *Brucine.* Dr. Bardsley, in his Hospital Reports, gives a favorable account of the influence of *Brucine* over paralysis, (see also Med. Bot. lii.) The leaves and young shoots of *B. Sumatrana* have, when bruised, a somewhat fetid smell, and an intensely bitter taste. Dr. Horsfield thinks it would be as serviceable a tonic as Quassia.

(4031.) The *Xanthoxyla* have hot and acrid properties; their barks and seed-vessels are especially pungent, and in the countries where they abound they are used as condiments, and popularly known as peppers, particularly those species which are included in the subgenus *Fagara,* as *X. piperitum* and *Rhetsa,* the seeds of which are agreeably aromatic, and are frequently used as ingredients in soups. X. *fraxineum* has apetalous flowers, and a tincture of its bark is recommended in chronic rheumatism. It is also said to be a powerful sudorific. *X. Clava-Herculis* has similar properties. The species are powerful sialogogues, and hence probably arises their efficiency in the relief of toothach, whence they have been called toothach-trees. *X. piperitum* and *hyemale* have been used as rubefacients; and the bark of *X. caribæum* is said to be a febrifuge. The wood of X. *emarginatum* is very fragrant when burned, and the timber of several species, as X. *hyemale,* is valued for building.

(4032.) The wood of *Ailantus excelsa* is light, and is used to make the catamarans or rafts, which the native fishermen in the parts about Circar use instead of boats.

Ailantus glandulosa, and *Malabarica,* yield resinous juices when wounded; and that of the latter was supposed by Miller to be the *Fasi-no-ki,* or spurious varnish tree of Japan; but this opinion, according to Don, is incorrect.

(4033.) *Polembryum castanæcarpon* is a remarkable plant, on account of each seed containing three embryos, unequal in size, and with unequal cotyledons; thus establishing another link of connexion with the *Aurantiaceæ.* [§ 3981.]

(4034.) *Ptelea trifoliata,* is the three-leaved ash of Canada. Its foliage has an unpleasant smell and bitter taste, and the young green shoots are used in infusion as an anthelmintic. The fruit, which is membranous and winged, is aromatic and very bitter, and has been employed as a substitute for hops; and, according to the report of M.M. Bauman, its use might be advantageously extended.

(4035.) SIMARUBIDÆ. *Quassia* and *Simaruba* are the two most important

genera included in this subtype; but *Simaba* and *Samadera* appear to possess similar properties, although, from being less known, they are less esteemed. An excessive bitterness is the predominant quality of the *Simarubidæ*, a bitterness pure and simple, yet extreme, and free both from astringency and aroma. They contain neither gallic acid nor tannin.

(4036.) *Quassia* commemorates a negro named *Quassi*, (or *Coissi*,) who discovered the febrifuge powers of its bark, and employed it with remarkable success in the treatment of the malignant endemic fevers which prevail at Surinam. The medicine made use of was for a long while kept secret, but was at length disclosed to Rolander for a valuable consideration. True *Quassia* is the wood of the *Quassia amara*, but a large proportion of that found in the markets is the produce of *Simaruba* (olim *Quassia*) *excelsa*. The amaritude of *Quassia* is supposed to depend upon a substance called emphatically the *bitter principle;* but some analyses seem to shew that a peculiar body is present in the Simarubidæ, differing from that found in other bitter plants, and which has been hence called *Quassine*. *Dr. Palmieri*, who has used *Quassine* with success in the treatment of agues, says it should be exhibited in double the ordinary dose of sulphate of quinine.

(4037.) *Simaruba officinalis*, which is the *bitter damson*, or slave wood, of Jamaica, with *S. excelsa*, *glauca*, and *versicolor*, are all very bitter plants, having the same properties as *Quassia*, for which they may be substituted, and are remarkably like it for the purity of their bitterness, containing neither tannin nor gallic acid, nor any astringent or aromatic principle. So bitter indeed are they, that specimens are left untouched by the Ptini, in the midst of other plants, which are devoured by them. Infusions of *Quassia* are used to poison insects, and a tincture of *Q. versicolor* is found very serviceable in destroying the vermin with which various parts of the human body are infested: the Brazilians likewise consider it an antidote to the bites of serpents. *Quassia* is said to be surreptitiously introduced by brewers, instead of hops, into their beer. The practice is, however, forbidden under severe penalties, and the beer made with *Quassia* is neither so pleasant, nor will it keep so long, as that which is made with hops. *Quassia* wood has been used in buildings and for making furniture, as well as for burning; but it is unfit for the latter purpose, as the atmosphere becomes unpleasantly bitter by its smoke, and victuals dressed by such a fire are said by Labat to be rendered uneatable.

(4038.) Ochnaceæ. *Ochna*, *Gomphia*, and *Walkera*, which, with their associates, *Elvasia* and *Castela*, and perhaps *Coriaria*, form the present type. They are trees or shrubs, abounding with watery juices; their stems and branches are very smooth, leaves simple, alternate, (in Coriaria alone opposite,) entire or toothed, penninerved, and furnished at the base with 2 stipules, which are caducous, or sometimes absent. The inflorescence is subracemose or paniculate, rarely solitary, and the pedicels mostly jointed in the middle. The flowers are regular, united, rarely polygamous by abortion, and in general yellow. The calyx is formed of 5 sepals, slightly connected at the base or campanulate, equal, persistent, and imbricate in æstivation. The petals are equal, hypogynous, 4-5 alternate with the sepals, or 10, imbricate in æstivation, and caducous; the torus is turgid and discoid, bearing the carpels arranged round the median style, which rises from the gynobase. The stamens are 5, alternate with the petals, rarely 8-10, or many, and exserted from the margin of the disk: the filaments are free,

often persistent, the anthers innate, 2-celled, and dehiscent internally, either lengthwise by chinks, or by terminal pores at the apex. The germen consists of 5-10 carpels, (equal in number to the petals,) arranged in a whorl on the turgid disk-like torus, (or gynobase,) with their styles combined, and forming a central straight thread-like column, that rises from the middle of the disk, and is persistent: in *Coriaria* the styles are absent: the stigma is capitate, or with as many clefts as there are carpels; each carpel is 1-celled, 1-ovuled, and the ovules are erect or pendulous.

The fruit consists of 10-5, or by abortion fewer carpels, which are subdrupaceous, indehiscent, and monospermous, each being articulated with the disk or gynobase, which enlarges with their development. The seeds are exarillate, erect, and exalbuminous in the three first-named genera, inverted and albuminous in the following two, inverted and exalbuminous in the last. The embryo is straight, the radicle short, inferior, and therefore turned towards the hilum, in all except Coriaria, in which it is superior. The cotyledons foliaceous in those genera which have albuminous seeds, thick and fleshy in those which are destitute of albumen.

(4039.) Hence, differentially considered, the *Ochnaceæ* are non-resinous *Rutinæ*, with alternate stipulate, rarely opposite exstipulate leaves, regular flowers, hypogynous stamens, whorled carpella, with a central style arising from an enlarged succulent torus, and solitary seeds.

(4040.) Three subtypes are here distinguishable, which, from *Ochna, Castela*, and *Coriaria*, are called the *Ochnidæ, Castelidæ*, and *Coriaridæ*.

(4041.) In the *Ochnidæ* the leaves are alternate and stipulate, the parts of the flowers have a quinary arrangement, the seeds are erect and exalbuminous, and the cotyledons are thick.

(4042.) In the *Castelidæ* the leaves are alternate and stipulate, the parts of the flowers have a quaternary disposition, the seeds are inverted, the albumen is fleshy, and the cotyledons foliaceous;

(4043.) While in the *Coriaridæ* the leaves are opposite and exstipulate, the branches angled, the buds scaly, the parts of the flower quinary in their arrangement, the seeds pendulous and exalbuminous, and the cotyledons fleshy.

(4044.) *Ochnidæ.* These are bitter plants, and some of them are esteemed as tonics, such as *Walkera serrata*, the leaves and roots of which, when steeped or boiled in milk or water, are administered as a stomachic, and are said to remove nausea and arrest vomiting. *Gomphia* (olim *Ochna*) *hexasperma* has a corky bark; it is also slightly astringent, and is hence found serviceable in Brazil as an application to the sores caused in cattle by the punctures of insects. *G. Jabotapita* has a fruit which is eatable, but it is rather too astringent to be agreeable; it likewise affords a bland oil, which is fit for salads and culinary purposes. The flowers of this plant, as well as those of the other species, are very fragrant.

(4045.) *Castelidæ.* *Castela Nicholsoni* is the goat-bush of Antigua: like its associates, it is chiefly remarkable for its bitterness; and, like them, it might be useful as a tonic.

(4046.) *Coriaridæ.* *Coriaria*, stands alone in this subtype; for the seven known species the genus includes differ so much from their nearest associates as to forbid their conjunction either with the *Ochnidæ*, to which they are now approached by De Candolle, or to the *Rhamnidæ*, to the vicinity of which he once referred them, and much less to the *Atriplices* or *Terebinthaceæ*, as hinted by

Jussieu and others. The most immediate allies of the *Coriaridæ* seem to be the *Ochnidæ*, from which however they are known by their long linear sessile stigmata, angled branches, and scaly buds. The whole of this type is related to the *Rutaceæ*, along with which they are principally arranged by Bartling; but they are non-resinous, and hence evidently form the transition from the one section to the other.

(4047.) The *Coriariæ* are astringent plants, and their leaves, especially those of *C. myrtifolia*, have been employed by dyers to strike a black colour with the salts of iron. Their succulent fruits are, if eaten in any quantity, poisonous. Sauvages witnessed death ensue in half an hour after some were eaten. And Pujada mentions an instance of fifteen soldiers who were poisoned by them in Spain; twelve of these men recovered, but three died. Many other cases are on record; and it appears that a kind of drunkenness is at first produced, which lasts for about half an hour; the face then becomes pale and livid, the speech is lost; there is foaming at the mouth, spasms of the muscles of the jaws, and horrible convulsions of the whole frame, death ensuing in about seventeen hours. The leaves and young twigs possess the same deleterious properties as the fruit, and when animals browse on them they are seized with intoxication attended by vertigo, and, if much has been eaten, by death. Accidents have happened in France from the leaves of this plant having been fraudulently substituted for senna, and administered to the sick instead of that drug. Guibourt and Dublance detected this iniquitous fraud, their attention having been directed to the circumstance of untoward symptoms following the exhibition of what was believed to be senna. One of the cases on record is that of a man who was seized at Hazebrouk with tetanus, after taking a small quantity instead of senna, and who died in four hours; the remains of the dose were given to a dog, which was killed by it in ten minutes. M. Fee has furthermore stated, that when he visited the drug-warehouses at Lisle, Turcoing, Menin, and their vicinities, in 1828, he found the senna almost universally adulterated with the leaves of the *Coriaria myrtifolia*, called in France *Redon* or *Redoul*. The detection of such frauds is however easy, as the leaves of the *Redoul* differ in their venation from those of the sennas, the basal costules being very long, divergent, and forming an extended intro-marginal line, instead of being equal with the other ribs. The leaves are also pointed, which they are not in the best senna (*Cassia obovata*), but this will not distinguish them from *C. acutifolia*, although to a practised eye the difference in form is obvious, and the venation alone is a sufficient guide.

ACERINÆ.

(4048.) This section, to which the *Maple* gives a common name, includes five types, or minor groups of genera, which, from *Sapindus*, *Æsculus*, *Acer*, *Malpighia*, *Hippocratea*, and *Brexia*, have been called the *Sapindaceæ*, *Æsculaceæ*, *Aceraceæ*, *Malpighiaceæ*, *Hippocrateaceæ*, and *Brexiaceæ*.

(4049.) Selecting the chief general characters, the *Acerinæ* may be collectively considered as non-resinous *Rhœadosæ*, with impunctate leaves, imbricate sepals, hypogynous petals and disk; definite, rarely indefinite stamens, carpels 2 or more, subconnate or coherent, and seeds exarillate, and mostly without albumen.

(4050.) The non-resinous juices of the *Ochnaceæ* would seem to indicate this as their proper location instead of the preceding section; but, as their general affinities are far from being definitively settled, it has been thought better to asso-

ciate them with the *Rutineæ*, near which, by De Candolle and others, they are most commonly arranged; and thus, although not blended with the *Acerinæ*, they are on the confines of the section, and form the transition from the foregoing to the present group; a connexion which is again strengthened by the pellucido-punctate leaves of the *Sapindaceæ*.

A. *Pavia rubra.* Cutting, to shew compound, petiolate, exstipulate leaves, racemose inflorescence, campanulate calyx, and irregular corolla.
B. *Acer Pseudoplatanus.* Cutting, to shew the lobed leaves and racemose inflorescence. (*a*) A flower isolated. (*b*) Ditto, with the calyx and corolla removed, to shew the hypogynous disk, one stamen, and the winged carpels. (*c*) The fruit, with one cell of the samara opened to shew the seed. (*d*) Another section, in which the seed has been cut, to shew the situation of the embryo. (*e*) A seed detached.
C. *Hippocratea scandens.* Cutting, to shew leaves and inflorescence. (*a*) Entire flower. (*b*) Section of the same. (*c*) A seed.

(4051.) SAPINDACEÆ. *Dodonæa, Sapindus, Paullinia*, and their typical allies, are trees or shrubs, rarely herbaceous plants, with erect or climbing stems, with alternate, often compound leaves, either stipulate or exstipulate, and frequently furnished with pellucid lines and dots, thus resembling the *Rutinæ*, especially when dried. The inflorescence is racemose or paniculate, the flowers united, or dithalamous by abortion, often inconspicuous, white or rose-coloured, rarely yellow, and the peduncles sometimes converted into tendrils.

The calyx consists of 4-5 sepals, either discrete or slightly coherent at the base, equal and imbricate in æstivation. The petals are usually the same in number as the sepals, but sometimes one is abortive, and occasionally, as in *Dodonæa*, *Stadmannia*, and *Amirola*, they are altogether wanting. In general they are

furnished with a petaloid scale, or bear a villous or glandular nectary, but they are sometimes naked. The torus forms an annular hypogynous or subperigynous disk, which is glandular. The stamens definite (8-10, rarely less or more), usually twice the number of the sepals, and exserted either from the receptacle or the disk: the filaments are free or very slightly connate, the anthers 2-celled, incumbent, and dehiscent introrsely by chinks. The germen is free, subrotund, formed of 3 (rarely 2) carpels, more or less connate or distinct. The ovules definite, collateral, and ascending when solitary, except in *Hypelate;* when the cells are 2-ovuled, the upper ovule is erect, and the lower suspended; the styles are more or less discrete or connate, and the stigmata simple.

The fruit is drupaceous or capsular, 3-celled, or by abortion 2-1-celled. The locules in general monospermous, the seeds attached to the axis, *i. e.* to the internal angles of each cell, exalbuminous, and usually arillate. The embryo is generally curved or spirally convolute, seldom straight; the radicle pointing towards the hilum, the cotyledons thick, incumbent, and the plumula 2-leaved.

(4052.) Hence, differentially considered, the *Sapindaceæ* are a- or poly-petalous *Acerinæ*, with unsymmetrical flowers, usually having villous or glandular nectaries, irregular stamens, 3 or 2 concrete carpels, axial placentæ, and definite exalbuminous seeds.

(4053.) Three subtypes are distinguished by De Candolle, which, from the three normal genera already named, have been called the *Dodonidæ*, *Sapindidæ*, and *Paullinidæ*.

(4054.) In the *Dodonidæ* the petals bear scale-like nectaries, the ovary is 2-3-celled, and the cells 2-ovuled; the pericarp vesicular or samaroid, and the embryo spirolobous.

(4055.) The *Sapindidæ* are non-scandent trees or shrubs, having petals with glandular or bearded nectaries, rarely none, the ovary 2-3-celled, and the cells 1-seeded.

(4056.) The *Paullinidæ* are twining shrubs or herbs furnished with tendrils, the petals having nectareous appendages, the ovary 3-celled, and the seeds solitary.

(4057.) As already noticed on several occasions with regard to other vegetables, the *Sapindaceæ* differ in their properties according to the parts of the plants employed, the leaves, branches, and other organs containing crude or only half-elaborated sap, being deleterious, while the fruit and seeds are eatable and wholesome.

(4058.) *Dodonidæ.* The twigs and leaves of *Magonæa glabrata* and *pubescens*, the *Pao de Tinguy* of Brazil, are narcotic, and are employed to stupify fish, as well as to make sedative lotions to apply to insect-stings and irritable sores.

(4059.) The leaves and young shoots of *Dodonæa viscosa* have an acid taste, and hence the shrub is known in Jamaica under the name of switch-sorrel; and a decoction of the wood of *D. angustifolia* is commended as an aperient and febrifuge. It has the odour of reinette apples, and is called the sand-olive in India.

The wood of *Eustathes sylvestris* is hard and durable, and is much employed for building in Cochin-china.

(4060.) *Sapindidæ.* The *Litchi* and *Longan*, which are very common and favorite fruits in China, are two species of a genus which has been called *Euphoria*, *Dimocarpus*, and *Nephelium*, by different botanists; the latter is, however, the preferable name. These fruits are sweet with a subacid flavour, and,

even when dried and brought to this country, they have a very pleasant taste, but when fresh they are said to be delicious. The trees will not bear either the heat or cold of the southern or northern parts of China, but are chiefly grown in the provinces of Fo-ki-en, Quan-tong, and Quan-si; whence the fruit is transported to other parts of that vast empire: but the flavour is much deteriorated by packing and carriage. Hence, to provide the emperor with this dainty in perfection, entire trees are conveyed by water from Quan-tong to Pekin at an enormous expense; one proof out of many which might be given of the more than regal magnificence with with the emperor is served, and the estimation in which this fruit is held.

Other species of *Nephelium* bear esculent fruits, but they are less agreeable than the preceding.

(4061.) *Melicocca bijuga, trijuga,* and *olivæformis,* are the honey-berries of the East and West Indies; they are of a dark colour, almost black, but very sweet and pleasant.

(4062.) The *Akee,* which from its grateful flavour is much esteemed both in Guinea and the West Indies, is the fruit of *Blighia sapida.* The fleshy carpels of *Erioglossum edule* are eaten in Japan, and that of *Schmidelia edulis* in Brazil, where it is called *Fruta de Parão.* The fruit of *S. serrata* is also edible, but that of *S. Cobbe,* a native of Ceylon, is said to be poisonous. The fruit of the former is astringent, and is employed on the Coromandel Coast in diarrhœa and dysentery; and the leaves of *S. Cochin-chinensis* are used, where the shrub grows indigenously, as cataplasms.

(4063.) *Sapindus* is a contraction of *Sapo-Indicus,* the old name of *S. Saponaria,* the soap-berry, so called from the detergent properties of its fruit, the outer pulpy parts of which have been used as a substitute for soap: this substance lathers freely with water, and, according to Browne, will cleanse more linen than sixty times its weight of soap. It is, however, acrid and corrosive, and if much care be not taken the clothes are injured and the skin excoriated. The seeds are hard, and were once mounted in gold and silver, and worn in this country as buttons, and are still used as such and for beads by the Spaniards. The bruised leaves, twigs, and fruit, when steeped in water, will intoxicate and poison fish, for which purpose the plant is often cast into ponds, streams, or creeks. The fruit of *S. Rarak* is said to form an equally good substitute for soap as the *S. saponaria*; and, notwithstanding the causticity of the preceding species, the fleshy fruit of *S. esculentus,* the *Pittombera* of Brazil, is eatable and wholesome, and that of *S. Mukorossi* is innocuous, though very bitter.

(4064.) PAULLINIDÆ. Some species of *Paullinia* are affirmed to be poisonous, while others afford eatable fruits and medicinal barks. Thus the arillus which surrounds the seeds of *P. subrotunda* is esculent and wholesome; the bark of *P. Africana,* in decoction and powder, is used as an astringent; that of *P. Asiatica* is esteemed as a febrifuge; it is a bitter pungent aromatic: the seeds of the *P. Cupana,* when infused and mixed with cassava, and allowed to enter into the putrefactive fermentation, form a favorite drink with the Orinoco Indians; and *P. Mexicana* is said to possess properties similar to sarsaparilla; while, on the contrary, the seeds of *P. pinnata* and other species are stupifying, and are used in the Antilles to intoxicate and capture fish; and De Candolle and St. Hilaire state that the Lechegauna honey owes its poisonous quality to the bees

resorting to the flowers of the *P. Australis*. The fruit of *Serjania triternata*, the supple-jack, is likewise intoxicating; and that of *S. lethalis* a deadly poison.

(4065.) The *Cardiosperma* are astringent plants. *C. Halicacaban* is the *Pois de Merveille* of the Antilles, where it enjoys a high, but it is to be feared a little merited reputation for miraculous lithontriptic powers. The root is mucilaginous, and has a nauseous slightly bitter taste; and it is said in decoction to be a serviceable laxative as well as an emollient.

(4066.) ÆSCULACEÆ. *Æsculus, Pavia*, and *Rhizobolus* or *Caryocar*, which, together, form this small group, are trees or shrubs, with opposite, palmate, petiolate leaves, destitute of stipules. The inflorescence is terminal, racemose, or subpaniculate; the pedicels in one subtype (*Hippocastanidæ*) articulated with the peduncle; and in the other (*Rhizobolidæ*) ebracteate. The flowers are united, rarely by abortion polygamous, and more or less irregular.

The calyx consists of 5 sepals more or less combined, sometimes campanulate, and imbricate in æstivation. The petals 5, or by abortion 4, unequal and alternate in the exsertion with the sepals. The stamens, definite in *Hippocastanidæ*, indefinite in *Rhizobolidæ*, are exserted from an hypogynous disk. The filaments are free or very slightly connate, the anthers oblong or subrotund, 2-celled, and bursting lengthwise by chinks. The germen is free, formed of 3 or 4 connate carpels, hence 4-celled, and the cells 1-2-ovuled; the styles connate or distinct, and the stigmata simple.

The fruit is coriaceous, formed of 3-4 connate carpels, 4-3 or by abortion 2-1-celled, and 1- or 4-seeded. The seeds are large and exalbuminous, the cotyledons being small and the radicle large in the *Rhizobolidæ*, while in the *Hippocastanidæ* the radicle is small, and the cotyledons very large and conferruminate. [§4050, A.]

(4067.) Hence, selecting the chief differential characters, the *Æsculaceæ*, collectively considered, are arboreous Acerinæ, with digitate leaves destitute of stipules, irregular flowers, simple naked petals, connate carpels, exalbuminous seeds, and large embryos.

(4068.) The difference of structure observable in the three included genera have led to their separation into two subordinate groups, called respectively the *Rhizobolidæ* and *Hippocastanidæ*.

(4069.) In the *Rhizobolidæ* the stamens are indefinite, the filaments connate, the anthers roundish, the germen 4-celled and 4-ovuled, each carpel becoming a hard indehiscent nut, the seeds kidney-shaped with a spongy dilated funicle, and the cotyledons small and lying in a furrow of the radicle, which is very large.

(4070.) In the *Hippocastanidæ* the stamens are definite, the filaments free, the anthers oblong, the germen 3-celled, the fruit coriaceous, 1-2-3-celled, 1-2-3-seeded, the seeds roundish, with a large hilum, curved smaller radicle, and very large fleshy conferruminate cotyledons.

(4071.) RHIZOBOLIDÆ. *Rhizobolus* or *Caryocar nuciferum* yields the *Saouri* nuts, which have a very rich oily taste, and are much esteemed as a dessert. They are commonly to be met with in the London markets under the corrupted name of *Suwarra* or *Suwarrow* nuts. The fruit of *C. glabrum* is also eatable, and the nuts of *C. amygdaliferum* taste like almonds. *C.* (or *Pekea*) *butyrosum* is the butter-nut; its seeds abound more than any of the other species in oil, which is

said to be equal to that procured from the olive. The kernels of *C. tomentosum* are less buttery, but more pleasant as food, and more easily digestible than the preceding.

(4072.) *Hippocastanidæ.* The different species of *Æsculus* and *Pavia* are commonly known under the name of horse-chesnuts, reference being obviously made to the external resemblance the fruit bears to that of the *Castaneæ*, and the very bitter astringent taste, which renders it unfit for human food. The seeds are large, and abound in farinaceous matter; hence they are very nutritious, and some animals, such as horses, are said to devour them greedily; others, such as sheep, goats, and deer, will also eat them, but for these latter they are generally steeped in lime-water to lessen their bitterness and acridity. If allowed to germinate they become sweetish, and then they will serve to fatten pigs and rabbits, and as fodder for cows. Their natural causticity renders them detergent, like others of their allies, and they have been used as a substitute for soap. A patent was taken out towards the close of the last century for the separation of starch from these seeds for domestic purposes, by which the consumption of much esculent grain might be avoided. The bark of the horse-chesnut is bitter and astringent, and has long been esteemed as a febrifuge. Zannichelli, and other continental writers, have even affirmed that in efficacy it is superior to cinchona, and their hyperbole has probably tended to consign it to unmerited neglect. During the war, when our supremacy at sea cut off the supplies of Peruvian bark from France, the bark of this tree entered into the composition of the numerous factitious cinchonas which were substituted for the genuine drug. It also yields a yellow colour, and has been used in dyeing.

(4073.) The horse-chesnut, though very common in this country now, was unknown in Europe three centuries ago. Parkinson says, "our Christian world had first the knowledge of it from Constantinople;" and, as an evidence of its rarity, Clusius states that there was in his time but one tree at Vienna, and that too young to bear fruit. Parkinson, above referred to, classes it along with the walnut and mulberry as an orchard-tree; and how little he knew about its properties may be surmised from his saying that it is not only greater and of more pleasant aspect for its fair leaves, but also of as good use for its fruit, which is of a sweetish taste, roasted and eaten, as the ordinary sorts. Its wood is light, and of no great value as timber; but the common one is a noble tree of rapid growth, and all the species are ornamental.

(4074.) Aceraceæ. *Acer* and *Negundium*, to which this group is now reduced by the segregation of various genera to form the contingent types, are trees with nodose branches, and in general saccharine juices, opposite, simple (rarely, as in Negundium, compound) leaves, petiolate, but destitute of stipules.

The inflorescence is axillary, the pedicels exarticulate, and furnished with minute caducous bracteæ, and the flowers regular, small, and either monœcious, diœcious, or polygamous, not simply monothalamous.

The calyx is free, deciduous, 5-4, rarely 6-9 cleft, often coloured, and imbricate in æstivation. The corolla (rarely absent) is formed of as many shortly unguiculate petals as there are lobes in the calyx, which they agree with in colour. The torus is hypogynous, discoid, fleshy, not adhering to the calyx, and bearing the stamens, the petals being exserted round it. The stamens are definite,

usually 8, rarely 5 or 12; the filaments free, the anthers oblong, sub-incumbent, 2-celled, and dehiscent introrsely by longitudinal chinks. The germen is formed of 2 connate carpels, each being 1-2-ovuled, the styles connate, and the stigmata simple.

The fruit is a samara, or indehiscent winged capsule, consisting of 2, rarely 3 connate carpels, each being 1-celled, and the cells 1-2-seeded; the seeds are erect, exalbuminous, and exarillate, but with a subcarneous testa or rather mesoderm. The embryo is curved or convolute, the cotyledons leafy and irregularly wrinkled, and the radicle roundish and inferior. [§ 4050, B.]

(4075.) Hence, differentially considered, the *Aceraceæ* are a- or apo-petalous *Acerinæ*, with simple lobed, rarely pinnate leaves, regular separated flowers, definite stamens, a 2-celled samara; exalbuminous, definite erect seeds, and wrinkled foliaceous accumbent cotyledons.

(4076.) The Maples are famed for the levity, hardness, and durability of their wood, which is likewise beautifully variegated. *Acer campestre* was once much employed in making pikes and lances, and lately in the manufacture of gun-stocks and musical instruments. It is also used by turners for making bowls and trenchers; and the old knotted parts, which are full of knurls, are much valued for their beauty, and sought after by cabinet-makers for inlaying. *A. Pseudoplatanus* is the sycamore or mock-plane, so called from its resemblance to the plane, which it almost equals in beauty, and is one of the best trees for maritime plantations, as it enjoys the wind and the spray, and will protect other kinds. Its wood being soft, is chiefly used for saddle-trees and plough-timber. Its sap contains a considerable quantity of saccharine matter, as indeed does that of most of the other species; this sweet juice, when collected by wounding the trees, and evaporated, affords an excellent sugar. The sap of *A. saccharinum* is very rich in saccharine matter; and in the continental parts of America, especially the Northern States, large quantities of sugar are procured from this plant, as well as from *A. rubrum* and *Negundo fraxineum:* the former is the swamp-maple of Canada; it affords a good and serviceable timber, and its bark is used as a blue dye, and also in the manufacture of ink.

(4077.) MALPIGHIACEÆ. The genera included in this type are small trees or shrubs, with opposite or alternate simple leaves, in general furnished with stipules, and impunctate.

The inflorescence is axillary or terminal, solitary or aggregate, often racemose, the pedicels bracteate, and sometimes articulated, and the flowers regular and united.

The calyx is formed of 5 sepals, slightly connate by their ungues, imbricate in æstivation, often glandular, and persistent. The corolla is pentapetalous, rarely abortive, the petals free and hypogynous in their exsertion. The torus is either obsolete, as in *Erythroxylidæ*, or discoid, as in *Malpighidæ*. The stamens are definite (10, seldom less), the filaments free or connate, the anthers innate, erect, roundish, 2-celled, and dehiscent lengthwise by chinks. The germen is formed of 3 connate carpels, 1 or 3-celled, the ovules solitary and pendulous, the styles distinct or connate, and the stigmata somewhat capitate.

The fruit is dry or succulent, 3-lobed and 3-celled, or by abortion 2 or 1-celled; the seeds solitary, exarillate, erect or pendulous, with or without albumen; the

embryo straight or curved, the radicle superior, the cotyledons fleshy or foliaceous, and the plumula very small.

(4078.) Hence, differentially considered, the *Malpighiaceæ* are a- or apopetalous *Acerinæ*, with simple leaves, symmetrical flowers, persistent sepals, definite stamens, connate carpels, and solitary ovules.

(4079.) The *Malpighiaceæ* are distinguishable into two subtypes, called, from *Erythroxylon* and *Malpighia*, the *Erythroxylidæ* and *Malpighidæ*, which Kunth elevates to the rank of independent orders; but, as Dr. Brown observes, they are very near akin, indeed so near, that their separation more than as subtypes seems scarcely justifiable.

(4080.) The *Erythroxylide* have dilated nectariferous petals, no disk, the filaments united to form a cup, the stigmata sessile, the fruit drupaceous and 1-celled by abortion, and the albumen corneous;

(4081.) While the *Malpighidæ* have unguiculate non-appendiculate petals, a discoid torus, free or connate stamens, developed styles, dry or baccate fruit, and exalbuminous seeds.

(4082.) *Malpighidæ.* The genera here associated have been by De Candolle arranged in 3 subtypical districts, called, from *Banisteria*, *Hiptage*, and *Malpighia*, the *Banisterieæ*, *Hiptageæ*, and *Malpighieæ*.

(4083.) The *Banisterieæ* are distinguished by having opposite, rarely verticillate or alternate leaves, distinct styles, and dry indehiscent fruit, often furnished with wing-like expansions;

(4084.) While the *Hiptageæ* have opposite or verticillate leaves, style single or connate, carpels dry and indehiscent, and usually winged;

(4085.) And the *Malpighieæ* have opposite leaves, distinct or connate styles, and a fleshy indehiscent fruit.

(4086.) *Malpighidæ.* Of the properties or uses of these plants there is very little known; several of the species have fragrant flowers, and the bark of some, as *Byrsonima crassifolia* (or *Moureila*) and *B. verbascifolia*, are bitter and astringent; that of the latter is used in decoction as a red dye as well as a detergent lotion, and the former, under the name of Savanna-bark, as a febrifuge, and also in the manufacture of leather. *B. spicata* is likewise used in tanning, and also employed medicinally as an astringent, under the name of dysentery-wood. The fruit of the *Malpighieæ* is eatable, and is commonly known as the Barbadoes-cherry: that of *M. glabra* is much esteemed in the British West Indies and on the American Continent. *M. saccharina* is the sugar-plum of Sierre Leone, and is brought in large quantities to the market in Free Town; and *M. punicifolia*, the bark of which is astringent, and the fruit when preserved delicious, yields a gum resembling gum-arabic. *M. urens, setosa*, and several other species, have leaves thickly armed with stinging hairs, resembling those of the cowhage: its fruit is insipid, but its bark is astringent. *Aspicarpa urens* is likewise a stinging plant; and the fruit of *Bunchosia Armeniaca* has been said to be unwholesome, and by some persons supposed to be poisonous.

(4087) *Erythroxylidæ.* *Erythroxylon*, as its name implies, is remarkable for the redness of its wood, a character likewise occurring in *Byrsonima verbascifolia* of the *Malpighiaceæ*, to which this small group, containing only the two genera *Erythroxylon* and *Sethia*, are nearly allied. They are, however, well

distinguished as a subtype, not only by their peculiar habit, but also, as Kunth has pointed out, by their appendiculate petals and albuminous seeds.

(4088.) *E. suberosum* has a corky bark, and its wood yields when steeped a reddish brown dye; in Brazil it is called *Galhinha-choco* or *Mercurio do campo.* The genuine *Coca,* which, when mixed with quicklime and the ashes of *Chenopodium Quinoa,* is chewed in *Quito* and *Papayan,* as the betel-nut is in other places, to remove fatigue and allay the pangs of hunger; it is however believed to be the fruit of *E. Hondense.*

The leaves of *E. areolatum,* when steeped in oil, are used in the East Indies as an embrocation; its wood is flesh-coloured, and forms good timber: that of *E. hypericifolium* is the *Bois d'huile* or *bois des dames* of the Mauritius.

(4089.) Hippocrateaceæ. *Hippocratea,* and its six allied genera which are included in this type, are scandent shrubs or trees, with in general smooth stems, opposite, simple, subcoriaceous leaves, entire or toothed, and furnished with small deciduous stipules. The inflorescence is axillary, paniculate, or in fascicles, and the flowers small, regular, and united.

The calyx is formed of 5 (seldom 4-6) very small sepals, semi-connate, and persistent. The petals are equal to the sepals in number, alternate with them, and subimbricate in æstivation. The torus is discoid or cyathiform, free from the calyx, but girding the ovary, and bearing the stamens. The stamens are 3 (rarely 5-10,) and exserted from the disk. The filaments dilated and connate below, and free above: the anthers 1 (seldom 2-4) celled, and dehiscent transversely at the apex. The germen, concealed within the tube of the connate filaments, is superior, discrete, 3-cornered, formed of 3 connate carpels and 3-celled: the ovules many, often definite in each cell, affixed to the central angular placentæ, biseriate, collateral, and in pairs. The styles are 3 and connate, and the stigmata connate or discrete.

The fruit consists of 3 dry or baccate carpels, connate, or by abortion sometimes reduced to 1 or 2, and usually many-seeded. The seeds, being erect, geminate attached to the axial placentæ, rarely solitary by abortion, and exalbuminous. The embryo is straight, the radicle inferior, the cotyledons elliptic-oblong, and somewhat fleshy.

(4090.) Hence, differentially considered, the *Hippocrateaceæ* are arborescent *Acerinæ,* with opposite simple leaves, very small imbricated sepals, entire, exappendiculate petals, staminiferous disk girding the ovary, mostly triandrous flowers, with usually 1-celled anthers dehiscing transversely, 3 connate carpels, indehiscent, wingless fruit, and erect exalbuminous seeds.

(4091.) These plants, included amongst his *Acera* by Jussieu, are distinguished by their stipulate leaves, 1-celled anthers, apterous fruit, and straight embryo, and in general most obviously by the quinary disposition of the perianth with the ternary development of the stamens; this, however, would appear to be the result of suppression; for in *Lacepedea* the stamens are 5, and in *Trigonia* 10 or 12. Whence these two genera have been considered aberrant, and termed *spurious Hippocrateaceæ.*

(4092.) *Hippocratea comosa* is the *wood almond* of the Antilles, and its seeds are oily, sweet, have a nutty flavor, and are esteemed as food. Its flowers have a bitter taste, and are said to be possessed of febrifugal powers. The fruits of *Calypso* (or *Tonsella,*) *Senegalensis,* and *pyriformis,* are sweet and pleasant. The seeds of *C. salacioides* are said to be albuminous, as well as those of the

Trigoniæ. The pulpy fruits of *Johnia Salacioides*, and *Coromandelliana*, are also esculent.

(4093.) Brexiaceæ. Two small groups, the first containing only the genus *Brexia*, and the second *Pittosporum*, and its allies, *Billardiera*, *Bursaria*, and *Senacia*, although often primarily separated, are here associated to form a common type, and rarely subordinately separated from each other. They would seem, however, to be sufficiently distinguished when arranged as subtypes of a common group with which this section, the last in the descending suborder, closes, and they are thus approached to the *Ilicinæ* of the *Myrtosæ*, to which, in several particulars, they bear a remarkable similitude.

(4094.) The Brexiaceæ, collectively considered, are trees or shrubs, with alternate simple leaves, and minute, deciduous, or absent stipules.

The inflorescence is terminal or axillary, solitary or aggregate; and in Brexia sertulate. The flowers are regular and united, or sometimes polygamous by abortion.

The calyx is inferior, free, formed of 5 sepals, more or less discrete or connate, deciduous in *Pittosporidæ*, persistent in *Brexidæ*, and imbricate in æstivation. The petals are 5, alternate with the sepals, free or slightly coherent, and likewise imbricate in the bud. The stamens are 5, hypogynous, alternate with the petals, and in *Brexia* exserted from a narrow cup-like disk, which in *Pittosporidæ* is obsolete. The filaments are free, or nearly so, the anthers innate, 2-celled, and dehiscent lengthwise by chinks. The germen is free, formed of 2-5 connate carpels, with 2-5 cells, and the placentæ axial and many-ovuled. The styles connate, and the stigmata distinct or connate.

The fruit is dry or succulent, 2-5 celled, with the dissepiments sometimes incomplete, and the cells many-seeded. The seeds in *Brexia* exalbuminous, with two distinct teguments; in *Pittosporidæ* usually covered with a glutinous or resinous pulp, and furnished with a fleshy albumen. The embryo is small, the cotyledons ovate, obtuse, and short; and the radicle cylindrical.

(4095.) Hence, selecting the chief differential characters, the *Brexiaceæ* may be defined as polypetalous *Acerinæ*, with simple leaves, imbricate sepals, definite hypogynous stamens, concrete carpels, axial placentæ, and many seeds.

(4096.) In the subtype *Pittosporidæ* the leaves are exstipulate, the disk obsolete, the fruit capsular or baccate, 2-5 celled, and the seeds albuminous, and invested with a resinous or glutinous pulp.

(4097.) While, in the *Brexidæ*, the leaves are coriaceous, and furnished with minute deciduous stipules, the stamens exserted from a hypogynous disk, the fruit drupaceous and 5-celled, the seeds with a distinct double spermoderm, and destitute of albumen.

(4098.) *Pittosporidæ*. The fruit of these plants is in general esculent, but sometimes rendered unpalatable by the resinous pulp that invests the seeds. *Billardiera* is the apple-berry of Van Diemen's Land. Several species of *Pittosporum* have fragrant flowers; and the barks of some, as *P. Tobira*, *viridiflorum*, and *coriaceum*, contain resin. The wood of *Senacia undulata* is beautifully veined, and hence sought after for ornamental works; by the French colonists in the Mauritius, it is called "*Bois de joli Cœur*."

(4099.) *Brexidæ*. Of the solitary genus *Brexia*, which forms this subtype, three species only have been as yet discovered. They are all natives of Mada-

gascar, and their properties are unknown. Their fruit being drupaceous is probably esculent; and the young shoots exhibit a resinous exudation, which in the *Pittosporidæ* is confined to the covering of the seeds.

(4100.) The general affinities of the two small subtypes here associated in a common group, are not very satisfactorily ascertained; both their union and their locality may admit discussion. Achille Richard considers the *Pittosporidæ* to be connected in many particulars with the *Rutinæ;* and De Candolle approximates them to the *Polygalaceæ;* while by Bartling and others they are in general brought near the *Celastrineæ,* towards which, in this returning suborder of the scale proposed to be adopted in the description of the Rosales, [vide 1909-10-11, &c.] they necessarily approach, and with the *Rhamnaceæ* and *Celastraceæ,* to which the *Brexidæ* are undoubtedly connected; a resemblance in habit being likewise shewn to exist between them and the *Myrsinidæ* of the *Syringales,* another affinity is indicated between the present and the succeeding order. The figurative circle is thus completed, and for systematic distribution it is a convenient scheme, even should it prove to be only a specious fiction. With a tabular conspectus of the sections contained in the three suborders of the Rosales, arranged according to their affinities and analogies, and a synoptical table of the included types, this department will be therefore closed.

(4101.) ANGELICOSÆ.

	Loranthinæ	Aralinæ	
	Angelicinæ		
MYRTOSÆ.	Cucurbitinæ	Vitinæ	RHÆADOSÆ.
	Grossulinæ	Cistinæ	
	Crassulinæ	Dianthinæ	
	Onagrinæ	Malvinæ	
	Myrtinæ	Hypericinæ	
	Rosinæ	Ranunculinæ	
	Cicerinæ	Rhæadinæ	
	Terebinthinæ	Rutinæ	
	Celastrinæ	Acerinæ.	

(4102.)

ANGELICOSÆ (3357.)

Subdivision	Order	Sub-orders
LORANTHINÆ (3359.)	*Loranthaceæ* (3360-1.)	
	Angelicinæ or Umbelliferæ (3388-9.)	
	Angelicaceæ (3391.)	Saniculidæ (3396.), Angelicidæ (3397.), Daucidæ (3398.)
	Coriandraceæ (3393.)	
	Smyrniaceæ (3392.)	Caucalidæ (3452.), Scandicidæ (3454.)
ARALINÆ (3367.)	*Corneaceæ* (3368-9.)	
	Araliaceæ (3375-6.)	

RHŒADOSÆ

Alliance	Subdivision	Order	Sub-orders
	CUCURBITINÆ (3320.)	*Papayaceæ* (3349-50.)	
		Cucurbitaceæ (3321-2.)	Cucumidæ (3325.), Feuillidæ (3324.)
	GROSSULINÆ (3267.)	*Loasaceæ* (3316-7.)	
		Turneraceæ (3313-4.)	
		Passifloraceæ (3299-3300.)	Malesherbidæ (3304.), Passifloridæ (3303.), Paropsidæ (3302.)
		Homaliaceæ (3295-6.)	
		Samydaceæ (3292-3.)	
		Grossulaceæ (3284-5.)	
		Nopalaceæ (3269-70.)	Rhipsalidæ (3274.), Opuntidæ (3273.)
	CRASSULINÆ (3207.)	*Fouquieriaceæ* (3262-3.)	
		Portulaceæ (3254-5.)	Telephidæ (3260.), Polycarpidæ (3259.), Portulidæ (3258.)
		Mesembraceæ (3245-6.)	Reaumuridæ (3250.), Nitraridæ (3249.), Mesembryanthidæ (3248.)
		Crassulaceæ (3235-6.)	Crassulidæ (3239.), Cephalotidæ (3238.), Galacidæ (3237.)
		Saxifragaceæ (3224-5.)	Heucheridæ (3231.), Saxifragidæ (3230.), Baueridæ (3229.), Cunonidæ (3228.), Escallonidæ (3227.)
		Hamameliaceæ (3218-19.)	
		Hydrangeaceæ (3210-11.)	Hydrangidæ (3214.), Philadelphidæ (3215.)
	ONAGRINÆ (3157.)	*Circæaceæ* (3203-4.)	
		Onagraceæ (3193-4.)	Lopezidæ (3205.), Jussidæ (3199.), Onagridæ (3198.), Fuschidæ (3197.), Montinidæ (3196.)
		Lythraceæ (3181-2.)	Lagerstroemidæ (3185.), Lythridæ (3184.)
		Rhizophoraceæ (3171-2.)	Cassipouridæ (3176.), Rhizophoridæ (3175.), Olisbidæ (3174.)
		Vochyaceæ (3166.)	
		Combretaceæ (3158-9.)	Combretidæ (3162.), Alangidæ (3161.)
	VITINÆ (3477-8.)	*Leeaceæ* (3480-1.)	
		Viteaceæ (3483-4.)	
		Meliaceæ (3503-4.)	Humiridæ (3500.), Melidæ (3501.), Cedrelidæ (3502.)
CISTINÆ (3524.)	HYPERICIANÆ (3625.)	*Garciniaceæ* (3528-9.)	Chrysopidæ (3531.), Calophyllidæ (3532.), Garcinidæ (3533.), Clusidæ (3534.)
		Hypericaceæ (3548-9.)	Eucryphidæ (3554.), Vismidæ (3555.), Hypericidæ (3556.)
		Frankeniaceæ (3559-60.)	Frankenidæ (3562.), Sauvagesidæ (3563.)
	CISTIANÆ (3526.)	*Violaceæ* (3566-7.)	Violidæ (3569.), Alsodidæ (3570.)
		Droseraceæ (3574-5.)	
		Cistaceæ (3578-9.)	
		Bixaceæ (3581-2.)	
		Flacourtiaceæ (3585-6.)	Flacourtidæ (3588.), Erythrospermidæ (3589.)
		Marcgraviaceæ (3594-5.)	Marcgravidæ (3597.), Norantidæ (3598.)
	DIANTHINÆ (3605.)	*Tamaricaceæ* (3600-1.)	
		Elatinaceæ (3607-8.)	
		Dianthaceæ (3610-11.)	Silenidæ (3613.), Alsinidæ (3614.)
	GERANINÆ or GRUINÆ (3618.)	*Linaceæ* (3620-1.)	
		Oxalidaceæ (3624-5.)	
		Balsaminaceæ (3631-2.)	
		Hydroceræ (3638.)	
		Tropæolaceæ (3639-40.)	
		Geraniaceæ (3642-3.)	
MALVINÆ (3647.)	MALVIANÆ (3648.)	*Malvaceæ* (3650-1.)	Malvidæ (3654.), Bombacidæ (3655.)
		Bromaceæ (3674-5.)	Dombeyidæ (3677.), Hermannidæ (3678.), Buttneridæ (3679.), Sterculidæ (3680.)
		Tiliaceæ (3696-7.)	Tilidæ (3699.), Elæocarpidæ (3700.), Dipterocarpidæ (3701.)
	CAMELLIANÆ (3649.)	*Chlenaceæ* (3710-11.)	
		Theaceæ (3714-5.)	Ternströmidæ (3719.), Camellidæ (3720.)

(1913.)

(3472.)

MYRTOSÆ	MYRTINÆ (3084.)	*Melastomaceæ* (3148-9.)	Charianthidæ (3153.) Melastomidæ (3152.)
		Memecylaceæ (3143-4.)	
		Gustaviaceæ (3130-1.)	Lecythidæ (3134.) Barringtonidæ (3133.)
		Myrtaceæ (3097-8.)	Myrtidæ (3102.) Leptospermidæ (3101.) Chamælaucidæ (3100.)
		Punicaceæ (3086-7.)	Granatidæ (3090.) Calycanthidæ (3089.)
ROSINÆ (2248.)	ROSIANÆ (2250.)	*Sanguisorbaceæ* (3077-8.)	
		Spiræaceæ (3065-6.)	Quillajidæ (3069.) Spiræidæ (3068.)
		Rosaceæ (3033-4.)	Neuridæ (3038.) Rosidæ (3037.) Fragaridæ (3036.)
	PYRIANÆ (2251.)	*Pyraceæ or Pomaceæ* (3001-2.)	Pyrenaridæ (3006.) Pyridæ (3005.) Dicalycidæ (3004.)
	PRUNIANÆ (2252.)	*Prunaceæ* (2224-5.)	Amygdalidæ (2257.) Chrysobalanidæ (2258.)
CICERINÆ (2024.)	MIMOSIANÆ (2021-2172.)	*Detariaceæ* (2241-2.)	
		Mimosaceæ (2220-1.)	
		Cassiaceæ (2173-4.)	Cæsalpinidæ (2177.) Geoffrayidæ (2176.)
	LOTIANÆ (2022-2033.)	*Swartziaceæ* (2165-6.)	
		Lathyraceæ (2112-3.)	Dalbergidæ (2117.) Phaseolidæ (2116.) Vicidæ (2115.)
		Lotaceæ (2035-6.)	Hedysaridæ (2040.) Lotidæ 2039.) Sophoridæ (2038.)
	CONNARIANÆ (2020-2027.)	*Connaraceæ* (2027-8.)	
	TEREBINTHINÆ (1968.)	*Burseraceæ* (2002-3.)	
		Spondiaceæ (1998-9.)	
		Cassuviaceæ (1969-70.)	Pistacidæ (1973.) Sumachidæ (1972.)
	ILICINÆ OR CELASTRINÆ (1919.)	*Rhamnaceæ* (1951-2.)	
		Bruniaceæ (1948-9.)	
		Celastraceæ (1933-4.)	Dulongidæ (1938.) Celastridæ (1937.) Staphylidæ (1936.)
		Aquifoliaceæ (1921-2.)	Aquifolidæ (1925.) Stackhousidæ (1924.)

Schizandridæ (3732.) Lardizabalidæ (3733.) Menispermidæ (3734.)	*Menispermaceæ* (3729-30.)	BERBERIANÆ (3725.)	RANUNCULINÆ (3724.)
	Berberaceæ (3741-2.)	RANUNCULIANÆ (3726.)	
	Anonaceæ (3749-9.)		
Magnolidæ (3761.) Illicidæ (3762.)	*Magnoliaceæ* (3758-9.)		
Dillenidæ (3770.) Delimidæ (3771.)	*Dilleniaceæ* (3767-8.)		
	Ranunculaceæ (3776-7.)		
Pæonidæ (3801.) Cabombidæ (3802.)	*Pæoniaceæ* (3798-9.)		
	Nelumbiaceæ (3815-6.)	NELUMBIANÆ (3727.)	
	Nymphæaceæ (3818-9.)		
	Sarraceniaceæ (3828-9)	RHAEADINÆ (3825.)	
	Papaveraceæ (3831-2.)		
	Fumariaceæ (3843-4.)		
Arabidæ (3851.) Sisymbridæ (3852.) Raphanidæ (3853.) Erucaridæ (3854.) Subularidæ (3855.) Schizopetalidæ (3856.)	*Brassicaceæ or Cruciferæ* (3848-9.)		
Cleomidæ (3938.) Capparidæ (3939.)	*Capparidaceæ* (3934-5.)		
	Resedaceæ (3946-7.)		
	Polygalaceæ (3952-3.)		
	Tremandraceæ (3961-2.)		
	Amyridaceæ (3967-8.)	RUTINÆ (3966.)	
	Olacaceæ (3975-6.)		
	Aurantiaceæ (3981-2.)		
Zygophyllidæ (4004.) Rutidæ (4006.) Simarubidæ (4006.)	*Rutaceæ* (4001-2.)		
Ochnidæ (4041.) Castelidæ (4042.) Coriaridæ (4043.)	*Ochnaceæ* (4038-9.)		
Dodonidæ (4054.) Sapindidæ (4055.) Paullinidæ (4056.)	*Sapindaceæ* (4051-2.)	ACERINÆ (4048.)	
Rhizobolidæ (4069.) Hippocastanidæ (4070.)	*Æsculaceæ* (4066-7.)		
	Aceraceæ (4074-5.)		
Malpighidæ (4080.) Erythroxylidæ (4081.)	*Malpighiaceæ* (4077-8.)		
	Hippocrateaceæ (4089-90.)		
Pittosporidæ (4096.) Brexidæ (4097.)	*Brexiaceæ* (4094-5.)		

SYRINGALES.

(4104.) In tracing the evolution of the various organs of the vegetable frame as characteristic by their progressive development of the several groups into which plants have been systematically arranged, with reference to their most obvious and important natural affinities, it has been found, that besides the great primary distinctions based upon the internal structure of the stem, its external form, and the gradual superaddition of foliage, flowers and fruit, there are certain subordinate modifications of development which subordinately distinguish the secondary and minor groups, such, for example, as the situation of the embryo, the nodes, and the leaf-sheaths in the *grasses* and *sedges;* the inferior and superior germen in the *Palmares;* the simple and divided stems and leaves in the *Pinares*, &c. &c.

The distribution of that very extensive group here denominated *Rosares*, the *Exogenæ angiospermæ* of De Candolle, which includes almost the whole of the Dicotyledons of Linneus and Jussieu, has been however more questioned, and is more debateable than any of the others. The absence of petals, or their presence, and when present, their continued separation or their union by their edges, were the distinctive characters selected by Jussieu, and adopted by most succeeding writers. By some, however, they have been rejected, and the types, or small natural orders, left without any intermediate grouping into sections, or a new mode of demarcation introduced. But none of the schemes appear to be more simple, or on the whole more practicable than the method of Jussieu; which, although it may need some improvement in the detail, is good in principle, and therefore seems rather to deserve revision than neglect.

(4105.) The Apetalous Rosares were included by Jussieu in his 5th, 6th, and 7th classes. The Polypetalous ones, in his 13th, 14th, and 15th classes, while the Syn- or Monopetalous *Rosares* were stationed in the intermediate four, from the 8th to the 11th inclusive. The same series is followed by De Candolle in his prodromus of the natural system ; but, as apetalous flowers more frequently change into apopetalous than into synpetalous ones, and as the corolla becomes very rarely indeed abortive in synpetalous plants, while in apopetalous ones its degeneration and absence is common, it does seem that the Apopetalæ should follow the Apetalæ, and be followed by the Synpetalæ, towards which some of them verge, as in the groups *Loranthinæ*, *Cucurbitaceæ*, *Crassulaceæ*, *Meliaceæ*, &c., rather than that those which were falsely called 1-petaled, but which, in

truth, are many-petaled, should be interposed to break the series in dicated by th progressive grades of evolution and metamorphosis.

(4106.) Modern physiology having shewn that the corolla of the once called *Monopetalæ* consists of as many petals as those of the so-termed polypetalæ, it has become necessary that words should be changed to suit to the change of science; hence, as *Apopetalous* has superseded *Polypetalous*, so *Synpetalæ* may supply the place of *Monopetalæ* with advantage, as being expressive of a truth, and not conveying a false impression. The great group, or order, which contains the synpetalous plants, like those which contain the a- and apopetalous ones, may also, like them, receive a common name from a well-known and familiar genus, viz. the *Syringa* or *Lilac*, whence has been derived the collective term *Syringales;* a word which not only indicates the general agreement of the whole with the Syringa in some general particulars, but also expresses the union of the petals, (often forming a tube or pipe,) which is the most common distinctive sign.

(4107.) Hence, differentially considered, the Syringales are *Synpetalous Rosares:* the perianth is double, the inner whorl or petals cohere by their edges so as to form a corolla, apparently of one piece; and this is in almost every instance readily distinguishable from those types of the Rosales which have petals occasionally coherent, by the union being complete and firm; for, in the catapetalous *Aquifoliaceæ*, and the other *Rosales*, with spurious synpetalous corollæ, the petals are easily separable from each other. The petals, as before observed, are very rarely absent from the syringales, *Glaux*, and a solitary species of *Campanula*, being perhaps the only examples.

(4108.) The natural associations included in this order, although far less numerous than those comprehended in the preceding, may nevertheless, like that, be conveniently distributed into 3 suborders, distinguished by the hypogynous, perigynous, or epigynous exsertion of the corolla, and which are equivalent to the classes VIII to XI of Jussieu, called Hypocorolly, Pericorolly, and Epicorolly, by Richard, the latter being subdivided according as the stamens are discrete or connate by their anthers into the Corisanthery and Synanthery of the last-named author. Here they are denominated, *Asterosæ*, *Ericosæ*, and *Primulosæ*, from *Aster*, *Erica*, and *Primula*, three well known normal genera, upon the principles of nomenclature, already explained. Hence

(4109.) The *Asterosæ* are epigynous *Syringales*, or synpetalous angiospermous Exogenæ, with epigynous corollæ;

(4110.) The *Ericosæ* are perigynous *Syringales*, or synpetalous angiospermous Exogenæ, with perigynous corollæ;

(4111.) And the *Primulosæ* are hypogynous *Syringales*, or synpetalous angiospermous Exogenæ, with hypogynous corollæ.

ASTEROSÆ.

(4112.) Three sections only are contained in this suborder, which, from *Rubia*, the Madder; *Valeriana*, the Valerian; and *Aster*, the Star-wort; are called *Rubiacinæ*, *Valerinæ*, and *Asterinæ*. These plants are in various particulars connected with the contingent groups of the Rosales; the Caprifoliaceæ are intimately connected with the *Loranthaceæ* and *Hederaceæ*, both by their epigynous

structure and the catapetalous corolla of *Loranthus;* and the affinities of the Valerinæ with the Aralinæ, and the Asterinæ with the Angelicinæ, are equally obvious, the calathus of the one being only a reduction of the umbellate inflorescence of the other; and I have a specimen of *Crepis*, in which the floscules have become pedicellate, and the head has assumed the aspect of an umbellate flower.

RUBIACINÆ.

(4113.) The genera included in this section form three natural associations or types, which, from *Caprifolium*, *Cinchona*, and *Rubia*, have been called the *Caprifoliaceæ*, *Cinchonaceæ*, and *Rubiaceæ*. From the latter of these there has been distinguished by *Bartling* a small group, termed by him *Lygosodeaceæ;* but which De Candolle combines with other genera, and retains as a subdivision of his *Rubiaceæ*, under the name of *Pœderieæ*. [Vide § 4128, 4157.]

(4114.) Collectively considered, the *Rubiacinæ* are epicorollous *Syringales* or Asterosæ, with nodoso-articulated stems and branches; the stamina discrete and alternate with the lobes of the corolla, the germen adnate to the calyx, and formed of 2-8 connate, 1- or many-ovuled carpels, and the radicle in general near the hilum.

(4115.) Caprifoliaceæ. The honeysuckle (*Caprifolium*,) and its typical allies, are shrubby plants, rarely either herbs or trees, with non-lactescent juices and simple opposite leaves, mostly exstipulate, but sometimes furnished with

A

Lonicera Caprifolium.

A. Branch to shew exstipulate leaves, inflorescence, and irregular flowers.

(*a*) Single flower, with the corolla laid open to shew the inferior germen and adnate calyx, and the stamens adherent to the tube of the corolla.

(*b*) Transverse section of the ovary.

(*c*) Ditto of the fruit.

(*d*) Fruit entire.

(*e*) A seed.

(*f*) Section of ditto, to shew the embryo included within the albumen.

(*g*) The embryo isolated.

minute, ciliate, or glandlike stipules. The inflorescence is terminal or axillary, and more or less crowded in cymes or sertula; and the flowers are regular, or very slightly irregular, and united.

The calyx consists of 5 (rarely 4) sepals, connate and adherent to the germen

by its tube, with a free 5-cleft limb. The corolla, mostly regular, but sometimes irregular, is synpetalous, the petals equal in number to the sepals, exserted alternately with them, and imbricate, or at least not valvate in æstivation. The stamens are equal in number to the lobes of the corolla, (one being occasionally abortive,) alternate with them in their disposition, exserted from the calyx, and adherent to the corolla. The filaments are free, subulate, sometimes short, and included, at others long and extruded beyond its limb; the anthers are ovate, incumbent, 2-celled, and dehiscent lengthwise by chinks. The germen is adnate to the calyx, formed of 3-4 connate carpels; when young, 3-4 celled, the styles filiform or absent, and the stigmata connate or discrete.

The fruit is baccate, indehiscent, fleshy, seldom dry, crowned with the limb of the calyx, plurilocular or 1-celled by the abortion of the dissepiments. The seeds are either solitary, in pairs, or many and pendulous. The spermoderm is crustaceous, the albumen fleshy, the embryo in the midst of the albumen, straight, with a superior radicle, and two ovato-oblong cotyledons.

(4116.) Hence, differentially considered, the *Caprifoliaceæ* are fruticose *Rubiacinæ*, with opposite exstipulate or substipulate leaves; a germen formed of 2-4 connate carpels, pendulous seeds, straight embryo, and fleshy albumen.

(4117.) The genera here associated are distributable into two subtypes, called, from *Sambucus* and *Lonicera*, the *Sambucidæ* and *Loniceridæ*.

(4118.) In the *Sambucidæ* the corolla is regular and rotate, seldom tubular, the styles absent, the stigmata 3 and sessile, the germen 3-4 celled, the ovules solitary, the inflorescence cymose, and the leaves serrate and substipulate;

(4119.) While, in the *Loniceridæ*, the corolla is more or less tubular, often irregular, the style filiform, the stigmata free or connate, the berry 2-4 celled, with the cells 1 or many-seeded, and the leaves entire and exstipulate.

(4120.) SAMBUCIDÆ. The elders and their allies form, by their inflorescence and the structure of their flowers, the transition from the Umbelliferæ to the present order. *Sambucus* is said to have been so called from *Sambuca*, (σαμβυκη,) an ancient musical instrument, perhaps the *Dulcimer*, which was made of its wood. The roots of *S. nigra* and *Ebulus* are cathartic, especially those of the latter, the leaves of which are said to be so disagreeable to mice, that they are strewed about barns to drive such intruders away. Its berries are also used as a blue dye. *S. nigra*, with its black and green-fruited varieties, *S. racemosa*, the red-berried, and *S. laciniata*, the parsley-leaved elder, are frequent in shrubberies and in village gardens. They are shewy plants when in flower and fruit, but their foliage is sombre. The flowers of *S. nigra* are diaphoretic, and in French pharmacy are commonly employed as expectorants. A fragrant water is procured from them by distillation, and they are also used to flavor vinegar. The French put them in layers between heaps of apples, or pack their fruit in casks with elder-flowers, to communicate to them an agreeable odor. Elderberries are said to be deleterious to poultry, especially to the turkey: when fermented with spice and sugar, they form a very inebriating wine, much esteemed by many people, and which, when drank hot, is far from being unpleasant. The undeveloped flower-buds of the elder make, when pickled, one of the best substitutes for capers. The elder will grow on high exposed lands, and forms a good nurse for maritime plantations; but in such localities it does not bear much fruit.

(4121.) *Viburnum Tinus* is the *Laurestine*, and *V. opulus* the Guelder-rose

or snow-ball-tree, both of which are very ornamental shrubs; the former is especially a favorite, from its blossoming throughout the winter. *V. Lantana* is the *way-faring* tree; its berries are esculent, but not very palatable, and bird-lime may be procured from its trunk and branches.

(4122.) *Loniceridæ.* The honey-suckles and their allies gradually recede in their general appearance from the *Umbelliferæ*, and establish, through Hedera and Cornus of the Aralinæ, which are intimately related to the *Sambucidæ*, a relationship with the *Rubiaceæ* and *Cinchonaceæ*, especially with the latter, which they resemble even in the form of the corolla, and in their opposite, non-verticillate leaves.

The *Loniceridæ* are rather astringent than purgative plants, but some are mildly cathartic; they are, however, less useful than ornamental, and are chiefly esteemed for the beauty and fragrance of their flowers, from which sweet-smelling essences and waters are drawn by the perfumers. Goats are very fond of their leaves, hence their common name of *Caprifolia* or *Chevrefeuilles.* The bark of *Lonicera* (? Loranthus) *corymbosa* is used for dyeing black, and that of *L. Tatarica*, which is fibrous, has been wrought into various fabrics. The fruits of several species, called *Chamæcerasi*, are said to have emetic properties; as is also that of *Triosteum perfoliatum*, if eaten in large quantities. The berries of the latter have, however, when dried and roasted, been used as a substitute for coffee.

(4123.) *Symphoria racemosa* is the snowberry; it, as well as *S. glomerata* and *punicea*, are pretty shrubs. The roots of *Diervillia Tournefortii* are reputed to be serviceable emetics, and, with those of *Triosteum perfoliatum*, are said to be used in North America indiscriminately with Ipecacuan, and often as a substitute for it.

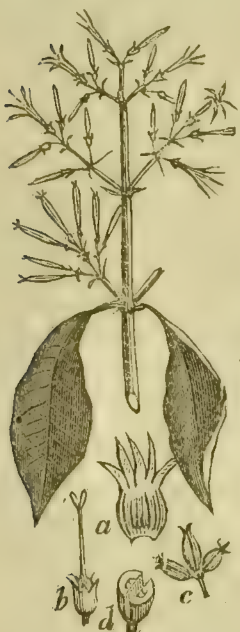
(4124.) Cinchonaceæ. The *Stellatæ* or *Rubiaceæ* of Linneus and Jussieu having been much enlarged by the discovery of many new plants, its subdivision has been found advisable. De Candolle proposes to distribute the genera now known to be allies to the Madder into 13 tribes, several of which are again divisible into subtribes. Bartling distinguishes 10 subordinate groups, and *Schlechtendahl* and *Chamisso* 12, exclusive of the *Stellatæ* or *Rubiaceæ*, properly so called, which are included both by De Candolle and Bartling. But these, as Lindley observes, being inconspicuous weeds, while the Cinchonaceæ are for the most part noble trees or shrubs, have, from habit, as strong claims to be separated from the *Cinchonaceæ* as that order from *Apocyneæ* or *Caprifoliaceæ:* and the more especially as their square stems and verticillate leaves afford very sufficient and obvious diagnostic signs. The old *Stellatæ* or *Rubiaceæ* are therefore now esteemed two distinct but contiguous types, or natural groups, the first or largest, from the Cinchona, being called the *Cinchonaceæ;* and the second, which is small and far less important, as it contains Rubia, the former typical genus of both, is named the *Rubiaceæ.*

(4125.) The Cinchonaceæ, collectively considered, are trees, shrubs, or herbs, with roundish stems and branches, and simple, entire, opposite leaves, with intrafoliaceous stipules, the stipules being sometimes solitary or in pairs, and free, and at others connate, forming a sheath. The inflorescence is varied, but in general paniculate; and the flowers are regular and for the most part united, although occasionally separate by abortion.

The tube of the calyx is adherent to the germen, with the limb epigynous or sub-

perigynous, and 4-5 cleft, sometimes 2-6 cleft, rarely obsolete, and with connate bracteæ at its base. The corolla is synpetalous, exserted from the upper part of

B



Cinchona oblongifolia.

B. Cutting, to shew opposite entire leaves and inflorescence.

(*a*) Flower cut open.

(*b*) The germen, with the adnate calyx, style, and stigmata.

(*c*) The fruit, formed of two connate separable carpels.

(*d*) Transverse section of the fruit to shew the seeds.

the tube of the calyx, tubular, regular, formed of 4-5, rarely 5-8 connate petals, which are deciduous and valvate, or imbricato-contorted in æstivation. The stamens are equal in number to the petals, united to them by their filaments, and alternate in their exsertion. The filaments are free and equal, the anthers 2-celled, incumbent, and introrse, and dehiscent longitudinally by valves; the pollen is elliptical. The germen is inferior, surmounted by an epigynous disk, formed of 2, rarely 4-6 connate carpels, and is hence 2- (seldom more) celled, or unilocular by abortion, as in *Opercularia*. The ovules many or few, erect or ascending, and attached to a central placenta. The styles connate, sometimes half discrete, and the stigmata usually simple, but sometimes divided.

The fruit is capsular, baccate, or drupaceous, inferior, and mostly indehiscent; 2 or many-celled, rarely unilocular, and the cells 1-2 or many-seeded, when definite erect or ascending, when indefinite mostly horizontal; the albumen is large, fleshy, or horny, the embryo small, straight, or slightly curved, and included within the albumen; the radicle round and turned towards the hilum, and the cotyledons thin and foliaceous.

(4126.) Hence, differentially considered, the *Cinchonaceæ* are epicorollous *Syringales* or *Rubiacinæ*, with opposite entire leaves, intrafoliaceous stipules, a regular corolla, connate carpels, and fleshy or corneous albumen.

(4127.) The numerous genera included in these important types imperatively demand subordinate distribution. The schemes hitherto proposed are far from being satisfactory; but, as that followed by De Candolle seems on the whole the best, it is here introduced with some slight modifications, rendered necessary by the exclusion of his Stellatæ, which form the true *Rubiaceæ* hereafter to be

described. The twelve subtypes included in this type may be collected into two primary divisions, the first containing five groups, in which the cells of the fruit are polyspermous; and the second, the remaining seven subtypes, in which the locules are 1, or very rarely 2-seeded. The arrangement and distinctive characters of these subordinate groups may be perhaps most conveniently shewn by reference to a tabular conspectus.

(4128.) DIVISION I.—FRUIT WITH POLYSPERMOUS LOCULES.

CINCHONIDÆ. Fruit capsular, 2-celled, seeds winged, albumen fleshy.

Naucleeæ. Flowers capitate and sessile on a globose receptacle.

Cinchoneæ. Flowers distinct and pedicellate.

GARDENIDÆ. Fruit indehiscent, fleshy, 2- (rarely by abortion 1-) celled, seeds not winged.

Sarcocephaleæ. Flowers and fruit sessile, and densely capitate and concrete.

Gardenieæ. Flowers distinct, pedicelled or sessile.

HEDYOTIDÆ. Fruit capsular, 2-celled, seeds not winged.

Rondeletieæ. Stipules in pairs, on each side, concrete or distinct, but neither vaginate nor setose.

Hedyotiæ. Stipules adnate to the petioles, vaginate at the base, and at the apex multisetose.

ISERTIDÆ. Fruit drupaceous, with 2-6 stones.

HAMELIDÆ. Fruit baccate, many-celled.

DIVISION II.—FRUIT WITH 1- (RARELY 2-) SEEDED CELLS.

CORDERIDÆ. Fruit baccate, many-celled.

GUETTARDIDÆ. Fruit drupaceous, 2-10 stoned, seeds round.

Morindeæ. Flowers and fruit aggregate and concrete in dense capitula.

Guettardeæ. Flowers distinct, more or less pedicelled.

PÆDERIDÆ. Fruit 2-celled, indehiscent, scarcely fleshy, the rind (*i. e.* the tube of the calyx,) easily separable from the carpels, which are much compressed posteriorly, and pendulous from a filiform axis.

Pæderieæ. Seeds with fleshy albumen.

Lygosodeeæ. Seeds exalbuminous.

COFFEIDÆ. Fruit baccate, 2-celled, seeds convex posteriorly, with flat faces traversed by a median furrow.

Coffeeæ. Flowers distinct and pedicellate.

Cephaelideæ. Flowers aggregate in a bracteate capitulum.

SPERMACOCIDÆ. Fruit subsiccate, 2-4 pyrenate, stigma bilamellate.

Cephalantheæ. Flowers and fruit sessile and densely aggregate on a globose receptacle.

Spermacoceæ. Flowers not sessile on a globose receptacle.

———————. Fruit dry and separable into 2-4 pieces.

Putorieæ. Fruit slightly fleshy and not separable.

ANTHOSPERMIDÆ. Fruit subsiccate, bipartible (rarely fleshy and 2-celled), stigmata long and hairy, leaves subverticillate with simple stipules.

OPERCULARIDÆ. Fruit 1-celled, 1-seeded, concrete in the capitulum, but at length dehiscing at the apex.

(4129.) The *Cinchonaceæ* are celebrated for their bitter and astringent properties, which render them valuable as febrifuges; these are combined frequently with an aromatic principle, by the union of which they become very agreeable tonics. In some an emetic principle is found, which either adds to their efficiency in the cure of diarrhœas and dysenteries, or, when concentrated, is used to nauseate or to provoke vomiting. The cinchona, the coffee, and the ipecacuan, are familiar examples of the group.

(4130.) *Cinchonidæ.* This subtype consists of shrubs or trees, with opposite entire leaves and intrafoliaceous stipules, a 2-celled capsular fruit, the seeds many in each cell and winged, and the albumen fleshy.

(4131.) *Naucleæ. Nauclea Gambir* (Uncaria Gambir of Roxburgh,) has very astringent leaves, which in India are chewed to relieve aphthous eruptions of the mouth and fauces. When boiled an astringent extract is procured from them which possesses nearly the same properties as kino; and the *Gatta Gambeer* is indeed often substituted for it in commerce. In Senegal the *N. Africana* is esteemed as a febrifuge, and the leaves are used to impregnate the waters of medicinal baths.

(4132.) *Cinchoneæ. Kina Kina, Kin Kina,* of which *Quinquina* is a corruption, seems to have been used emphatically as the name of the Cinchona, in the same manner as we call it pre-eminently Bark; *Kin,* in the original language of Peru, signifying bark, and *Kin-kin* or *Kin-kina* meaning when translated "the Bark of Barks;" its value as a febrifuge being thus simply and forcibly expressed. But the barks of various other trees possessing bitter properties, although far less efficacious than the genuine cinchonas, have been confounded with them in commerce; and, although Peruvian bark is perhaps without a parallel in the number of treatises which have been written to celebrate its virtues and to describe the plants by which it is afforded, still some doubts are reasonably entertained as to the identification of the officinal cinchona-trees: and, notwithstanding upwards of 630 authors are enumerated by Bergen as having written 808 books, pamphlets, and essays, in elucidation of the subject, it must be confessed that our knowledge is still very far from being complete.

(4133.) The modern genus *Cinchona* includes only about sixteen or eighteen known species, many of the plants called cinchonas by Lambert and the older writers being now referred to the contiguous genera of the district, as more accurate examination has shewn them to be not only different in properties, but in structure generically distinct.

(4134.) Of the numerous sorts of bark introduced by traders from Peru there are three which have obtained pre-eminent celebrity, and these have been admitted into our national Pharmacopœiæ. In commerce they are known as, 1st. the grey or brown bark; 2d. the yellow; and 3d. the red bark.

(4135.) Of the grey or brown bark there are several varieties, such as the *Lima,* the *Loxa,* and the *Huanaco.* The *Loxa* or crown-bark, which is the most esteemed of all, is, according to Humboldt, procured from the *Cinchona Condaminea.* The *Lima,* of which druggists distinguish three qualities, is said by Mutis to be the bark of *C. lancifolia,* and the Huanaco is believed to be the bark of *C. purpurea.* It is of a darker colour than either of the others.

(4136.) Of the yellow barks there are also three kinds, the Calisaya or yellow-royal; the Carthagena; and the royal yellow Quinquina. The first of these is

said to be the older bark from the trunk and larger branches of *C. lancifolia.* The second and third, of the two varieties of *C. pubescens* known in general under the names of *C. ovata* and *cordifolia.*

(4137.) The red bark, and its variety, the orange, are the least valued, and much the least in demand of the whole. They are believed to be the barks of *C. oblongifolia,* and the difference in their colour is supposed to be owing to the different age of the parts of the tree from which they are taken.

(4138.) Other species of Cinchona are used as febrifuges; but, as they seem to be inferior to those above described, their use is local.

(4139.) The genuine Cinchonæ contain two alkaloids, called *Cinchonia* and *Quinia,* in various states of combination, and upon these peculiar proximate principles their febrifuge powers are believed chiefly to depend. They exist in very different proportions in the different barks, and even in the same kind of bark of different ages. M. Sertuerner has published an account of a third alkaloid, which he says he has discovered in cinchona bark, possessing, according to his account, febrifuge powers far surpassing those of Quinine. And M. Theos, of Naples, has announced the discovery of a fourth alkaloid, differing essentially from the preceding; but further observations are wanted to verify the existence of the two last-named bodies.

(4140.) *Exostemma,* which is well distinguished from Cinchona by its protruded stamina, simple stigma, and entire seed-wings, includes several genera very rightly separated from the Cinchonæ, not only on account of their structural differences, but also because they are destitute of both the alkaloids, *Cinchonia* and *Quinia.* Some of them are nevertheless useful medicines, their febrifuge properties being dependent on their aroma and bitter principle. The *Quinquina Piton* is the bark of *E. floribundum; Quino do meto* of *E. cuspidatum. E. Caribæum* also yields a medicinal bark, which has been used as a febrifuge in the Antilles.

(4141.) The Brazilian barks, which are far inferior to those of Peru, are the produce of several species of *Remigia,* especially of *R. Hilarii, ferruginea,* and *Vellozii.* The Guiana bark is procured from the *Coutarea speciosa,* and that of Carolina from *Pinkneya pubens.*

(4142.) The wood of *Hymenodiction excelsum* is valuable as timber, and is said to be as good as mahogany: its bark is also bitter. The bark and root of *Manettia cordifolia* are said by Von Martius to have emetic properties, and they are used in decoction by the Brazilians in the treatment of dropsy. Vahl furthermore reports that *M. lanceolata* is esteemed in Arabia as an antidote to the bite of serpents; and, according to M. Du Petit-Thours, the roots of *Danias fragrans* abound in red colouring matter, and they are used as a red dye by the natives of Madagascar.

(4143.) The GARDENIDÆ are shrubby or arboreous Cinchonaceæ, with baccate fruit, polyspermous cells, wingless seeds, and fleshy albumen.

(4144.) *Sarcocephaleæ. Sarcocephalus esculentus* bears an eatable fruit, which in Guinea and Sierra Leone is called the African peach. *Zuccarinia* and *Lucinæa* have not hitherto been applied to any useful purpose.

(4145.) *Gardenieæ.* The flowers of *Mussænda Stadmanni,* and *M. Landia,* have been used in the Isle of France as diuretics and expectorants; their barks are also bitter, and are there called native quinquina. Several species of Genipa

have pulpy eatable fruits, such as *G. Americana*, and *Merianæ esculenta*, and *edulis*. Their juice, which is of a dark colour, is used as a black dye, and that of *G. Caruto* and *oblongifolia* is employed in Peru and on the banks of the Orinoco as a cosmetic. The roots of *G. Americana* are purgative, and the wood of *G. oblongifolia* forms serviceable timber.

(4146.) The berries of *Gardenia aculeata* afford a fine blue dye, and those of *G. grandiflora* when boiled will dye silk of a beautiful red colour. The roots of *G. dumetorum* are said by Ainslie to be emetic, and *G. gummifera* exudes on the surface of its leaves and within the cracks of its bark a resinous substance resembling *Elemi*, and which Springel believes to be the Cancamon of the ancients. *Gardenia florida* is a handsome shrub with very fragrant flowers, and hence it is a favorite in amateur collections. The *Gardeniæ* are remarkable for the contorted æstivation of their corollæ; a character which approaches them to the *Apocyneæ*, and strengthens the general connexion of these two otherwise related groups. The berries of *Randia Dumetorum* have intoxicating powers, and are used to inebriate and capture fish. The fruit of *Catesbæa spinosa*, which is as large as a pullet's egg, has an agreeable acid flavour, and is eaten in the West Indies.

(4147.) The *Hedyotidæ* are herbaceous or shrubby *Cinchonaceæ*, with a 2-celled capsular fruit, either indehiscent or dehiscing loculicidally, the cells polyspermous, the seeds not winged, and the albumen fleshy.

(4148.) *Rondeletieæ*. The *Chyn-len* of the Chinese is believed to be the root, or rather the rooting stem of *Ophiorhiza Mungos*. It is extremely bitter; and Ainslie tells us that it is used in India as an antidote to the bites of venomous serpents. In China it is much extolled, and it is there sold at an exorbitant price.

(4149.) *Hedyoteæ*. The *Chaya* of India and Persia is the root of *Hedyotis*, now called *Oldenlandia umbellata*. In the East it is considered a potent aphrodisiac; it is much used in the seraglios, and is held in great esteem by the Turkish sultanas. The root of *O. corymbosa* is employed as an anthelmintic in the West Indies; and that of another species, probably *O. herbacca*, but said by some authorities to be *O. umbellata*, furnishes a fine red dye. Its leaves are also stated to be possessed of expectorant properties, and are made into lozenges to relieve difficulty of breathing.

(4150.) *Isertidæ*. *Isertia*, *Metabolos*, and *Gonzalea*, are herbaceous or shrubby *Cinchonaceæ*, with drupaceous polyspermous fruit and fleshy albumen. None of the species of the three included genera have hitherto been used as food, as medicine, or in the arts.

(4151.) The *Hamelidæ* are arboreous or shrubby *Cinchonaceæ*, with polyspermous multilocular baccate fruit, and seeds with fleshy albumen.

(4152.) *Hamelia patens* is called "Mort aux rats" by the French West Indians. Its berries are eatable and wholesome to man. In the Antilles a sort of wine is made of their juice when fermented, and an astringent syrup is composed of them, which is said to be serviceable in bowel complaints. The fruits of *Brignolia acuminata* are also eatable.

(4153.) *Cordieridæ*. This, the first subtype of the second division of the *Cinchonaceæ*, includes those genera with solitary seeds in which the fruit is baccate and multilocular. They are nearly related to the *Hamamelidæ*, which precede

them, and the *Guettardidæ*, which follow; from the former they are however distinguished by their monospermous locules, and from the latter, in the fruit being truly many-celled and not pyrenose. *Cordeira* and *Tricalysia*, each containing but a single known species, are the only two genera at present included in the group.

(4154.) The *GUETTARDIDÆ* are *Cinchonaceæ*, with polypyrenous drupaceous fruits, the stones being 2-5 in number, and each but 1-seeded. The seeds are long and round, and the albumen fleshy.

(4155.) *Morindeæ.* The *Cada, Calava,* or *Nono* of Tahiti, is the *Morinda citrifolia;* its fruit, when roasted, is eaten in India as a preventive of dysentery, and is esteemed as an expectorant; its root is also said to yield a saffron-coloured dye, and that of *M. tinctoria* to make ink, and, according to the mourdants, to dye red or black. The roots of *M. umbellata* are likewise used to form a yellow dye; a decoction of its leaves is administered medicinally as an astringent in cases of diarrhœa and dysentery. Other species, such as *M. Chachuta*, likewise yield colouring matter.

(4156.) *Guettardeæ.* The fleshy succulent fruits of *Vangueria edulis* and *spinosa* are both esculent; the latter is about the size of a cherry, and of a yellow colour. They are common in China and Madagascar. The flowers of some of the *Guettardæ* are fragrant, but their fruits are not eaten as food. The roots and bark of *Antirhœa verticillata* are reputed to be powerful astringents. In the Isle of Bourbon it is called "Bois de Losteau," and is used as a styptic to restrain hæmorrhage; a circumstance alluded to by Commerson in its generic name. *Nonatelia officinalis* is the asthma-bush of Guiana, where its leaves are used medicinally, and are considered serviceable expectorants.

(4157.) The *PÆDERIDÆ* are scandent shrubs, with an indehiscent 2-celled fruit, scarcely fleshy, the tube of the calyx easily separating from the carpels, which are 1-seeded, compressed, and pendulous from a filiform axis. The albumen is also fleshy.

(4158.) *Pæderieæ.* *Pæderia fœtida* is the *Candolay* of the Philippine Isles. Its leaves have a very offensive stercoraceous odour, and yet they are used to impregnate baths, and in decoction are administered internally in retention of urine, and in certain febrile complaints.

(4159.) *Lygosodeeæ.* The *Lygosodeæ*, included in this group by De Candolle, are separated by Bartling on account, amongst other characters, of their ex- or sub-albuminous seeds; but their differences in structure do not seem to be such as to warrant their segregation, at any rate farther than to form them, as here is done, into a district of the subtype *Pæderidæ*.

(4160.) *COFFEIDÆ.* The *Coffea*, and its subtypical associates, are arboreous or shrubby *Cinchonaceæ*, with a 2-celled baccate fruit, the nucules in pairs, 1-seeded, osseous or crustaceous, and the albumen horny.

(4161.) *Coffeeæ.* Of the numerous genera and species included in this district the coffee is the most familiar and important. There are many species of the genus *Coffea*, the seeds of all of which, as well as those of the other allied genera, which have horny albumen, might be used, when roasted, in the preparation of a pleasant aromatic beverage, but none have been found on the whole superior to the *Coffea Arabica*, which is almost the only one in cultivation. *C. Mauritania* is the marron-coffee of the Isle of Bourbon; it must not however be mistaken

for the Bourbon coffee of commerce, which is a mere variety of the Arabian: and *C. Benghalensis*, which is a native of Nipal and the mountains of Silhet, has been used as a substitute for that of Arabia, but its berries are smaller in size and inferior in quality. The different kinds of coffee met with in commerce, such as the Mocha, the Bourbon, Plantation, &c. are varieties occasioned by soil, situation, and mode of culture, for the whole of the West Indian plantations are the descendants of a single plant presented by the Dutch to Louis XIV., in 1714; and it was not till some years afterwards that a few of its offsets were sent to Surinam, Cayenne, and Martinico; so that, important as the coffee has become as a branch of colonial commerce, it has not been introduced into the West Indies much more than a century; and the East Indian plantations were likewise derived from the same common source, viz. a single plant which Governor Witsen presented to the Botanic Garden at Amsterdam, and which had been raised in Batavia from seeds procured by him from Mocha, in 1690. The Mocha berries are smaller, and possess a higher flavour than those which are brought from the West Indies; this has been commonly attributed to the effects of temperature, soil, and culture. It should however be remembered that the increased size of the plantation-berries depends upon the superdevelopment of the corneous albumen, and this, as in all other cases, lessens the relative, if not also the absolute quantity of the aromatic principle upon which the flavour depends. But the rate at which Mocha coffee is sold is so little higher than that of the plantation-berries, that it is more profitable for the planters to produce *quantity* than to regard quality: and it is even said that if the West Indian coffee be kept for several years, instead of being roasted and consumed as soon as it can be transported across the Atlantic, that its flavour improves, and nearly approaches to that of the Mocha. The coffee seeds when unroasted are nearly tasteless, the agreeable smell and flavor being developed during torrefaction, by a new arrangement of the elements of which their proximate principles consist.

(4162.) The Arabic name of the plant is *Qahoueh*, and of this word the Persian *Cahwa*, the Turkish *Cahvey*, the French *Café*, and our *Coffee*, are evidently corruptions. The use of coffee, as a nourishing and agreeable beverage, has been traced to a very remote epoch; but, whether it arose in Arabia or Persia, seems not to be determined. That its use was known in Persia in 875 is said to be proved by some ancient manuscripts preserved in the Royal Library at Paris. In 1517 it was introduced into Turkey by Selim, after his conquest of Egypt, but it was more than a century after this before it was known in the different capitals of Europe. Public coffee-houses began to be established in Italy in 1645. Some were opened in London in 1652, but it was not until 1671 and 2 that we hear of any such establishments in France, viz. at Marseilles in the former year, and Paris in the latter. It sold at first at an exorbitant price, as high indeed as four or five guineas a pound; and, by an act of the 12th of Charles II. cap. 24, a duty of fourpence the gallon was imposed upon all coffee made and sold in houses licensed for the purpose. This was eight years after the first coffee-house was opened in London, which is recorded to have been kept in George-yard, Lombard-street, by one Pasqua, a Greek, who was brought to this country by a Turkey merchant of the name of Edwards. The quantity of coffee now imported into Europe is calculated at between one and two hundred million pounds, upwards of thirty millions of which are consumed in France.

On its introduction into Constantinople much prejudice existed against its use. It was proscribed as an intoxicating beverage, and the shops were ordered to be shut by the Mufti, who complained that the Mahommedans forsook the mosques and crowded the coffee-houses. Its use was also forbidden by the Syrian government. But, notwithstanding the most severe prohibitions, it has become in Turkey almost a necessary of life: indeed, so essential was it at one time considered, that the refusal of a husband to supply his wife with a reasonable quantity of coffee, was enumerated and admitted amongst the legal causes of a divorce.

(4163.) M. de Tressac says that the pulpy matter which invests the coffee-seeds affords when fermented an alcoholic liquor; but spirit is seldom or never procured from this source for economical purposes. A peculiar proximate principle has been extracted from the torrefied seeds, which has been called Caffeine. It is said to be possessed of exhilarating properties, such as are developed in coffee by roasting; and it contains a larger proportion of nitrogen (21·54 per cent.) than most other vegetable bodies. Coffee has been used medicinally in various derangements of the chylopoietic viscera, and in headachs resulting from indigestion. Its most remarkable property, however, is its power of relieving drowsiness, and of retarding the access of sleep for six or eight hours. Hence its introduction after dinner to remove the torpor that follows repletion; hence also its more common use as a morning than as an evening beverage, and the impropriety of taking it late at night, or soon before going to bed, at least if sleep be desired. These properties, which are by some persons regarded as infelicitous, prove its chief recommendations to others, especially to literary men, who frequently take it in excess, in order to prolong their studies unconquered by sleep, the mind seeming to be enlivened by its use, and the body invigorated and calmed. It appears likewise to induce far less depression and nervous irritability than are known sometimes to follow too free indulgence in the use of tea. The Turks and other Asiatic nations, to whom indolence is enjoyment, moderate the effects of coffee by mixing opium with it. Brute animals appear likewise to be subject to its influence, for it has been affirmed that the goats which in Arabia browze on the leaves and eat the fruit of the coffee are remarkable for their liveliness and gamboling. Coffee is a more fit drink for persons of a lymphatic and sluggish temperament than for those of a lively sanguineous habit; more wholesome, according to the French writers, for the old than for the young, and more required by men than women.

(4164.) *Pavetta Indica* is a bitter astringent plant, the roots of which have been used in dysentery. *Chiococca anguifuga* and *densifolia*, are said to be obnoxious to serpents, and antidotes against their venomous bites. These assumed properties are, however, only imaginary. The roots of both plants are bitter, but far less active as medicines than *C. racemosa*, the *Caïnca* of Brazil, which is probably the true *Raiz preta*, so much extolled for its medicinal virtues. The root of this plant in infusion is said to act powerfully as an emetic and cathartic. It has hence been found serviceable in some cases of insanity, and has been administered with success in amenorrhœa and dropsy.

(4165.) Notwithstanding the exclusion of many species which form several contingent genera, the *Psychotriæ* still remain very numerous, upwards of 170 being enumerated in his Prodromus by De Candolle. Of these several are reputed to be possessed of emetic properties, and their roots have been used as

substitutes for ipecacuan. *P. emetica* is the streaked or black ipecacuan of Mutis; *P. cordifolia* and *herbacea* are said by some persons to have similar properties; but De Candolle believes their virtues to be merely conjectural. The roots of *Psychotria sulphurea* and *tinctoria* have been used as dyes.

(4166.) *Palicourea,* a genus nearly allied to *Psychotria,* contains several active and poisonous species, which, from their use in Brazil to destroy rats and mice, have received the name of *Ervo do ratto,* or ratsbanes. The infused leaves of *P. diuretica, officinalis, longifolia, sonans,* and *strepens,* are reputed, when administered in small doses, to be powerful diuretics, and are used both in human and veterinary medicine. *P. speciosa* is employed in Brazil in the same diseases as *Guaiacum, Mezereon* and *Sarsaparilla;* and *P. tinctoria* forms a fine red dye, much valued in Peru.

(4167.) *Cephaelideæ.* Ipecacuan, one of our most certain and serviceable emetics, is the root of the *Cephaelis emetica* of Persoon; the *Callicocca Ipecacuanha* of Brotero. *Callicocca* is now made a subgenus of Cephaelis by De Candolle, the structural differences being too slight to keep it generically distinct. Until lately much doubt existed as to the plants which yielded the true officinal *Ipecacuan,* and the roots of various plants, such as several species of *Ionidium, Richardsonia, Psychotria, Cynanchum, Periploca,* and *Viola,* are known in commerce as the *brown,* the *white,* and the *black* Ipecacuans. The name, however, belongs correctly to the *Cephaelis Ipecacuanha* alone, it being a compound of *Ipi,* the Peruvian word for *root,* and *Cacuanha,* the name of the district from which it is chiefly procured, and hence means the *Cacuan root,* just as Cinchona is called *Peruvian bark.*

(4168.) Ipecacuan is valuable not only for its emetic properties, but also as a sudorific, and for its power of restraining intestinal fluxes. It was the basis of the celebrated medicine with which *Helvetius* treated dysentery so successfully, that Louis XIV. gave him 1000*l.* to reveal the secret of its composition.

(4169.) The *SPERMACOCIDÆ* are herbaceous or fruticose *Cinchonaceæ,* with a dry or scarcely fleshy fruit, consisting of 2- (rarely 3-4) 1-seeded mericarps, either concrete or separable, sometimes dehiscent, sometimes indehiscent, and seeds furnished with fleshy or subcorneous albumen.

(4170.) *Cephalantheæ.* The button-wood of the West Indies is the *Cephalanthus occidentalis:* it is reputed to be serviceable in cachectic habits, and has been recommended in the treatment of obstinate cutaneous affections, but little is at present known of its properties and powers.

(4171.) *Spermacoceæ.* Several species of Richardsonia possess emetic properties, such as *R. scabra, Braziliensis,* and *rosea;* the former is the *Poaya do campo* of Brazil, or the white Ipecacuan of commerce. Its roots are much finer and smaller than those of the true drug, indeed, almost filamentary; and much weaker, and less certain in their action.

(4172.) *Putorieæ. Serissa, Ernodea, Cuncea, Hydrophilax, Plocama,* and *Putoria,* are the genera included in this district, but of their properties there is nothing at present known, save that the flowers of *S. fœtida* have a very disagreeable odor.

(4173.) The *ANTHOSPERMIDÆ* are herbaceous or suffruticose *Cinchonaceæ,* with the flowers sometimes diœcious, the corolla rotate, the styles 2, discrete from the base, and terminating in long hairy stigmata. The fruit consists of two

mericarps, easily separable when ripe, each being 1-seeded and indehiscent, with fleshy albumen; and the leaves sometimes subverticillate with small stipules.

(4174.) *Anthospermum*, *Coprosma*, and the other genera included in this subtype, are chiefly interesting from the connexion which they corroborate between the *Cinchonaceæ*, as now distinguished from the *Rubiaceæ*, properly so called; for, although the stipules, which form the most obvious distinctive character, continue, and although the leaves in *Coprosma* and *Galopina* are simply opposite, in Phyllis they occur in whorls of 3 or 4; and in *Anthospermum* several species, as *A. Lichtensteinii, hirsutum, lanceolatum, ciliare*, &c. have opposite leaves; while others, as *A. Bergianum* and *Æthiopicum*, have them subverticillate.

(4175.) *Opercularidæ.* *Pomax* and *Opercularia*, which are associated to form this small subtype, are herbaceous or suffruticose *Cinchonaceæ*, with concrete flowers surrounded by an involucrum; the calycine tubes simulating a peculiar operculum, the corolla 3-5 cleft, the stamens 1-5, scarcely adnate to the tube of the corolla, the style short, the stigmata 2, long, slender, and acute. The fruit, by abortion, 1-celled and 1-seeded; concrete, 2-valved, and at length dehiscent. The inflorescence is aggregate, the capitella being sometimes pedicled and umbellate, at others sessile and capitulate, surrounded by many-toothed involucella, and often furnished with a general involucrum.

(4176.) The structural modifications in this border-group, with which the type *Cinchonaceæ* closes, are extremely interesting; for, although primarily and closely related to their typical allies, they establish by their modes of inflorescence a secondary connexion with both the Umbelliferæ and Compositæ, as well as by the variable number of their stamens, confirming that relationship with the *Valerianaceæ* which is established by their general characters.

(4177.) Rubiaceæ, or *Stellatæ*. Those genera being excluded which are now associated to form the preceding type, *Cinchonaceæ*, the seven which remain constitute a small and comparatively an insignificant group, reduced as much in extent as it is in importance. And, although it seems expedient to admit the segregation, the close affinity of the two must be constantly regarded; for, as De Candolle observes, the supernumerary leaves, which constitute the whorls, are probably but stipules greatly developed, which view seems to be confirmed by the opposite ones alone being gemmiferous, and the axillæ of those which are intermediate being destitute of buds.

(4178.) The *Rubiaceæ*, collectively considered, are herbaceous plants, with square or angled stems, and whorled exstipulate leaves; the verticilli being formed of two opposite gemmiferous leaves, with a variable number of intermediate ones, not varying in appearance from the general foliage, but destitute of buds; hence being stipulaceous, and supplying the place of the interpetiolar stipules of the *Cinchonaceæ*. The inflorescence is paniculate, the flowers small, in general united, rarely diclinious by abortion.

The calyx is superior, the tube adnate to the germen, and the limb 4-5-6 lobed. The corolla is synpetalous, rotate, or infundibuliform, regular, with the number of its petals equal to the sepals, exserted from the calyx, and valvate in æstivation. The stamens are equal in number to the petals, (or lobes of the corolla,) and exserted alternately with them; the filaments are free, and the anthers incumbent, 2-celled, and dehiscent longitudinally by chinks. The germen consists of 2 connate carpels, invested by the adherent tube of the calyx; it is

2-celled, the ovules being solitary and erect, the styles 2, either distinct almost from the base, or more or less connate, and the stigmata capitate.

The fruit consists of 2 dry, indehiscent, 1-seeded mericarpia, with the seeds solitary, erect, scarcely distinct from the pericarp and calyx. The albumen corneous, the embryo straight in the axis of the albumen; the radicle inferior, and the cotyledons leafy.

Sherardia arvensis.

c. Cutting, to shew the verticillate exstipulate leaves.

(*a*) A flower isolated.

(*b*) The calyx adnate to the germen, the corolla and stamens being removed.

(*c*) Section of the germen to shew the seeds, one in each mericarp.

(*d*) The fruit.

(*e*) A section of ditto.

(*f*) The ripe fruit.

(*g*) A longitudinal section, to shew the 2 mericarpia.

(*h*) A transverse section.

(*i*) A seed, shewing the embryo.

(*k*) The embryo separate.

(4179.) Hence, differentially considered, the *Rubiaceæ* are stellate *Rubiacinæ* with angled stems, whorled scabrous leaves destitute of stipules, 2-celled dry fruit, with solitary erect seeds, and horny albumen.

(4180.) The roots of the *Rubiaceæ* often contain a large quantity of colouring matter. This is especially abundant in the Madders, *Rubia Tinctorum,* and *Mungista,* and several species of Galium.

(4181.) Madder is used both as a dye-stuff, and also as a pigment. The madder-lakes, formed by precipitating the colouring matter from its infusion by alum, are, when carefully prepared, superior in tint to cochineal. Madder is not much grown in this country, although the climate suits it well enough, because it can be imported from abroad at a lower price than it can be raised at home. Our chief supplies are received from Holland, France, Italy, and Turkey. Madder, like several other *Rubiaceæ,* tinges the secretions and excretions of animals that feed upon it. The urine and milk, and even the bones, become dyed red; and curious preparations are formed by feeding pigs and other animals alternately on madder and ordinary food, by which means the constant deposition of osseous matter and its constant removal can be shewn by the alternate layers of red and white in the bones, and the subsequent disappearance of all adventitious colour, when the use of madder as a food has been discontinued for a sufficient length of time.

(4182.) A Brazilian species of Rubia, hence called *R. noxia*, is reported to be poisonous; further information is, however, required on this point.

(4183.) The stalks and flowers of *Galium verum* have been used in the cheese counties, especially in Gloucestershire, to curdle milk, and to give the curd a rich colour, as the stalks abound in a yellow matter, which has also been used as a dye-stuff. The roots afford a red dye, resembling madder; indeed, its colour is said to be superior, and it was once grown as a substitute for the Rubia, but the roots are too small to render its culture profitable. *G. Aparine*, the common goose-grass, was called by the Greeks *Philanthropon*, as they fancifully attributed the readiness with which it cleaves to our habiliments to a love of the human species. A mechanical cause will, however, offer a more satisfactory solution. This plant is said by Dioscorides to have been used in his time as a kind of filter to strain milk through, and Linneus tells us that it is still used in Sweden as a substitute for sieves; indeed, the asperities of its stalks and leaves render it very fit for such a purpose. Its expressed juice has been extolled as an antiscorbutic; and in the provinces it occasionally enters as an ingredient into the composition of spring broths, and is believed by the country people to be a great purifier of the blood. The seeds having a corneous albumen, form, when roasted, a very good substitute for coffee, far better than roasted corn; and our peasants would do well to set their idle children to collect the seeds, which are to be found in profusion on every hedge. The roots of *G. tuberosum* are farinaceous, and the plant is cultivated in China as a dietetic vegetable. Loureiro says, that when boiled they are esteemed both wholesome and nutritious. They are either eaten whole, or made into meal. *G. Mollugo* has been extolled by M. Jourdan, the director of the hospital at Tain, in Dauphiny, as an effectual cure for epilepsy. It is however to be feared that his cases, the reports of which are not a little marvellous, will not justify much reliance being placed on its powers.

(4184.) *Sherardia* commemorates one of our greatest botanical cultivators, whose Eltham garden is still in grateful recollection, and even in existence. *Asperula odorata* has a sweet smell, resembling that of *Anthoxanthum odoratum*, which depends on the benzoic acid they both contain, and, like it, this plant is not fragrant while growing, but gives out its odors when weltering after being cut. It is said to be possessed of diuretic powers. *A. cynanchica* is the old quinsy wort, once much esteemed in the treatment of sore throats. *A. tinctoria* has roots which yield a red colouring matter that in Gothland is used to dye wool. The vaunted antilyssic properties of the *Asperulæ* are unworthy notice.

VALERINÆ.

(4185.) Two small types, called *Valerianaceæ* and *Dipsaceæ*, from the normal genera. *Valeriana* and *Dipsacus* are alone included in this section, which contains a short but interesting series of aggregate flowers with discrete stamens, and is strictly transitional between the *Rubiacinæ* preceding, and the *Asterinæ* that follow; the *Valerianaceæ* being especially connected to the former, and the *Dipsaceæ* to the latter, from which indeed they scarcely differ, excepting by the non-cohesion of their anthers: a distinction, however, which becomes abrogated in *Xanthium*, and obsolete in *Tussilago hybrida*, both of which belong to the syngenesious section, although their stamens are discrete.

(4186.) Collectively considered, the *Valerinæ* are herbaceous (seldom shrubby)

Asterosæ with epicorollous flowers, the germen, however, being sometimes free, the corolla imbricate in æstivation and staminiferous, the filaments and anthers discrete, an inferior 1-3-celled ovary, and solitary pendulous seeds, with superior radicle.

(4187.) VALERIANACEÆ. The *Valerians,* and their typical associates, are annual or perennial herbaceous plants, rarely becoming suffrutescent at the base, with thick strong smelling roots in those which are perennial; and slender, scentless ones in those which are annual. The stems are nodose, the leaves opposite, exstipulate, and variable in form; even in the same species the lower ones being simple or less divided than the upper, which are often pinnatifid or laciniate.

The inflorescence is terminal, and in cymose or corymbiform panicles, or glomerulate or sub-capitate by the shortening of the pedicles. The flowers are united, rarely by abortion diœcious, 1-3 bracteate, and of a white, pink, or blue colour; sometimes, yet seldom purple, as in *Nardostachys;* or yellow, as in *Patrinia.*

The tube of the calyx is adnate to the germen, the limb dentate or cleft, and sometimes membranaceous, and sometimes pappose. The corolla epigynous, being exserted from the top of the germen, infundibuliform with a 5 (or occasionally a 3-6) cleft limb; the lobes obtuse and imbricate in æstivation, the tube calcarate or gibbous at the base, staminiferous and deciduous. The stamens are 5 or less, exserted from the tube of the calyx, and alternate with its lobes, the filaments free, and incurved in æstivation; the anthers ovate and incumbent, 2-celled, and dehiscent longitudinally by chinks. The germen is formed of 3 strictly connate carpels, 3-celled, the locules uniovulate, and the ovules pendulous. The style connate and filiform, and the stigmata free or concrete.

The fruit is capsular, dry, subcoriaceous, and indehiscent; 3-celled, with often 2 empty locules, or rarely by abortion 1-celled. The seed is solitary, pendulous, exarillate, and without albumen. The embryo is straight and inverted, hence with a superior radicle; and the cotyledons are flat, oblong, and entire.

(4188.) Hence, selecting the chief differential characters, the *Valerianaceæ* are aggregate, corriantherous, monospermous *Asterosæ, i.e. Valerinæ* with a cymose bracteate inflorescence, strictly adnate calyx, 3-celled germen, becoming often a 1-celled fruit, with exalbuminous seeds.

(4189.) The Valerians are in general ornamental plants; the leaves of most are esculent, and used as salad-herbs. *Valerianella olitoria* (or *Fedia Locusta,*) is the lamb's lettuce of our provinces, and, if sown in autumn on a warm border, it affords an abundance of good early salad. The roots of the perennial *Valerians,* especially of those which grow in tolerably dry situations, are aromatic, and highly stimulating. They are used medicinally in hysterical complaints, and their powers have been highly extolled. The *Phu* of Dioscorides appears, from the researches of Dr. Sibthorp, to be specifically distinct from the *V. Phu* of modern botany, and he has figured it in the *Flora Græca* under the name of *V. Dioscoridis.* This plant grows abundantly in Lycia on the banks of the Linyrus, and has a much more powerfully aromatic and less nauseous smell than our British officinal valerian, the taste of which may, however, be disguised by the addition of mace.

(4190.) The odour of valerian seems to be most peculiarly agreeable to cats, who will chew its roots, roll on it, and become for a time intoxicated under its influence. Rat-catchers are also said to use it as they do oil of anise, to draw their prey toge-

ther; for rats, like cats, appear to be spell-bound by its power. And, although the odour is in general thought unpleasant by European nostrils, it is so much admired by Eastern nations, that some of the most esteemed Asiatic perfumes are composed of valerian: and *Valeriana Celtica*, which is the Celtic spikenard, is often used to impregnate the waters of baths, and render them fragrant. *Nardostachys* (olim *Valeriana*) *Jatamansi* is believed to be the true spikenard of the ancients.

(4191.) Dipsaceæ. The Teasel, and its typical associates, are herbs, or rarely suffruticose plants, with round nodoso-articulated stems, and opposite (rarely verticillate) simple leaves, entire or pinnatifid, sessile and amplexicaul, or petiolate and semi-amplexicaul, and destitute of stipules.

The inflorescence is terminal and densely capitate, rarely verticillate, and surrounded by a many-leaved general involucrum, each flower being also furnished with a bractea or chaffy scale. The flowers are united.

The calyx is superior and membranous, the tube investing the ovarium and adhering to it, at least at the summit; the limb is variable, either short or long, entire or toothed, and sometimes pappiform, and surrounded by a scarious involucellum. The corolla is synpetalous, exserted from the tube of the calyx, and deciduous; the limb is bifid, or, by the union of the two upper lobes, 4-cleft, often unequal, sometimes sub-ringent, and imbricate in æstivation. The stamens are 4, exserted from the tube of the corolla, alternate with its lobes, and incurved or induplicate in æstivation. The filaments are free and distant, and sometimes sub-didymous: the anthers discrete, incumbent, linear, obtuse at either end, exappendiculate, 2-celled, and dehiscent longitudinally by chinks. The connectivum is abortive. The pollen grains free, smooth, and subtetrahedral. The germen oblong, inferior, 1-celled, the ovulum solitary and pendulous, the style terminal and filiform, its base adhering to the tube of the calyx, and the stigma simple and lengthened, or subcapitate.

The fruit is 1-celled, dry, membranaceous or subnucamentaceous, indehiscent, crowned with the persistent limb of the calyx, and often invested by the involucel or paleaceous bracteæ. The seed is solitary and pendulous, the albumen fleshy, the embryo straight, in the axis of the albumen, the radicle short and superior, and the cotyledons oblong and entire.

(4192.) Hence, differentially considered, the *Dipsaceæ* are capitate *Rubiacinæ* with an involucellate calyx, induplicate free stamens, a 1-celled germen, and solitary pendulous albuminous seeds.

(4193.) The six genera here associated are distributable into two subtypes, the first, called *Morinidæ*, including only the single genus *Morina*, and the second, called *Scabiosidæ*, the remaining five, viz. *Dipsacus*, *Cephalaria*, *Knautia*, *Pterocephalus*, and *Scabiosa*.

(4194.) In the *Morinidæ* the corolla is ringent, the stamens sub-didynamous or connate by pairs, and the flowers verticillate and bracteate;

(4195.) While in the *Scabiosidæ* the corolla is 4-5-cleft and not ringent, the stamina 4-5 and nearly equal, the flowers capitate, and each calyx surrounded by a proper involucel.

(4196.) The *Dipsaceæ* are not remarkable for any active medicinal properties or for their dietetic uses; several species of Scabius, such as *S. succisa*, are astringent, and a decoction has been recommended as a specific for discharges from certain mucous membranes. *Scabiosa atropurpurea*, a fragrant and very

ornamental plant, is one of those which has been so long under cultivation that its native country is unknown. It has been employed as a green dye; and might, it is said, be even useful in tanning leather.

(4197.) *Dipsacus pilosus* has been commended as a sudorific; and the larva of a small insect that infests the heads of *D. sylvestris* is said by Lemery to be an efficacious remedy in intermittent fevers. The water contained in the hollows of the connate leaves, called Venus' cups, is esteemed as a cosmetic; but the most important application of the teasel is in carding woollen cloths, for which purpose vast quantities of the variety called Fuller's teasel (*Dipsacus Fullonum*) are cultivated in our southern countries and on the continent. No mechanical contrivance has yet been found to supersede the use of the teasel in dressing woollen cloths, each piece of which consumes from 1500 to 2000 teasel-heads. The teasel is generally grown by labourers and small farmers: as there is much trouble in drying the heads, and as the produce is greatly affected by season, it is always regarded as a casualty crop, the market-price varying, according to such circumstances, from 4*l.* to 22*l.* per pack. A pack contains 9000 of the terminal and largest teasel heads, which are called kings; or 16,000 of the lateral ones, which are smallest, and called middlings. The middlings are also termed princes; they are finer, and sell at a higher price than the kings, which are only fit for dressing coarse cloths, while the others are used for the finer and more delicate kerseymeres.

A. *Valeriana officinalis.* Cutting, to shew leaves and inflorescence.
(*a*) Flower isolated.
(*b*) Ditto laid open, to shew the exsertion of the stamens.
(*c*) Pistil.
(*d*) Fruit, with its crown of pappus.

B. *Dipsacus sylvestris.* Cutting, to shew the opposite leaves and capitulate inflorescence, with the general and partial involucres.
(*a*) Section of a capitulum, to she the common receptacle, the aculeat bracteæ, and the flowers.
(*b*) A flower separated.
(*c*) Section of the staminiferous corolla, to shew the exsertion of the stamens, and its origin from the faux of the calyx, surrounded by its involucel.
(*d*) Fruit invested, with its exterior calyx, which is laid open.
(*e*) Section of the fruit, to shew the axile embryo in the fleshy albumen.
(*f*) The embryo.

(4198.) The *Dipsaceæ* are peculiarly interesting plants, on account of the immediate connexion they establish between the *Umbelliferæ* and *Compositæ*, their mode of inflorescence being that of the former, while the involucella that surround the individual florets resemble the involucella of the partial umbels of

the *Angelicinæ*, and, like them, more than a single flower is, according to the observations of Coulter, occasionally contained in one involucel. The normal character of the complete adhesion of the tube of the calyx to the germen being modified in several species of scabiosa by its adhesion only at the upper part, while the tube is free from the ovarium that it invests, is also a very remarkable peculiarity, as the germen is thus free while the flower is superior, being a most admirable explication of the true nature of inferior and superior fruits.

ASTERINÆ.

(4199.) The Starworts, the Sunflowers, and their allies, which, from their stellate mode of inflorescence, have received their generic names, *Aster*, *Helianthus*, and *Heliopsis*, as well as their modern collective appellations, *Asterinæ*,

A. *Cichorium Intybus*. Cutting, to shew leaves and inflorescence. (*a*) A flower isolated, to shew the inferior germen, the ligulate or one-lipped corolla, and the syngenesious stamens. (*b*) The fruit, an akenopsis. (*c*) The root.

B. *Carduus Marianus* or *Silybum Marianum*. Cutting, to shew leaves and inflorescence. (*a*) Flower separated, to shew the inferior germen, calyx in the form of pappus, and tubular corolla. (*b*) Ditto, with the corolla laid open. (*c*) Fruit crowned with the pappus.

C. *Xanthium strumarium*. (*a*) A stamineous flower separated. (*b*) Section of a pistilline one, to shew the seed.

Asteraceæ, &c. form one of the most extensive and most generally acknowledged natural associations in the whole vegetable kingdom. The resemblance of these plants to each other is so obvious, that their affinity has ever been recognised, and, as long as systematic arrangements have existed, so long have the starworts, with

little modification, been admitted as one of the most natural groups. By some of the older systematists, as Cæsalpinus, Morrison, and Ray, and even by Jussieu, those starworts which have a distinct radius and disk were separated from those which consist of disk alone, or which have radiant flowers only; but still their common affinity was confessed by their juxtaposition. From their aggregate inflorescence giving to each head of flowers the appearance on a superficial view of being but a single flower, notwithstanding the complete distinctness of the several or numerous floscules, the starworts and their allies early obtained the designation of compound flowers, a term which arose in the dark ages of vegetable physiology, and which, though still retained, is altogether objectionable. Not so much, however, from the exceptions which have been raised against it on account of the false impression it is presumed to convey, as from the fact, that if the composite character of flowers depends on the mode of inflorescence, many other plants besides those now comprehended under the term are equally compound, as the *Dipsaceæ;* and, if it be made to consist in the union of the anthers, exceptions are not wanting; while, even if the combination of both peculiarities be required, the *Calycereæ* will form dissentients on the one hand, and *Xanthium,* with *Kühnia,* on the other; for the former are excluded, although their inflorescence is capitulate and their anthers syngenesious, while the latter are included, notwithstanding their anthers are discrete.

(4200.) These circumstances seem to require some reform in the arrangement and association of this important natural group; so that, while the minor distinctions are admitted, the more general connexions may not be too rudely severed. By Ray, who distinguished the so-called compositæ into four groups, the *Dipsaceæ* were associated with the third, under the name of *Corymbiferis affines,* thus shewing, from their interlocation, that the mode of inflorescence was esteemed by him as the most important diagnostic sign; and, although subsequent researches have shewn the connexion of the anthers to be a character of superior value, they have likewise proved the older name (*compositæ*) to be now less applicable to the group than even in the time of Ray; and, indeed, though retained by Linneus, it was discarded by Jussieu, and the term *Synantheræ* substituted by Richard and Cassini. Lobel and Pena called the group *Serides* sive *Intyba, i. e.* succory or endive-like plants, while by Jussieu the three subordinate groups already referred to are separately named *Cichoraceæ*, *Corymbiferæ,* and *Cynarocephalæ:* the former two being names adopted from Cæsalpinus, Morrison, and Ray; and the whole three equivalent to the *flosculous*, *semiflosculous,* and *radiated* compound flowers of Tournefort.

(4201.) Hence, as the term *compositæ* is objectionable, both on account in the one view of its including plants not immediately belonging to the group, and on the other by its excluding some which are intimate allies, and, furthermore, as it has not even antiquity or originality to boast, it may well give place to the word *Asteraceæ,* to designate the normal starworts, and *Asterianæ*, *Asterinæ,* and *Asterosæ,* for the successively larger and more general collective grades, the first including the *compositæ* of Linneus and De Candolle, the second those of Bartling, and the third comprehending all the compound flowers of Ray, with their immediate allies, the Valerians &c. which by him, as by Linneus and Jussieu, were interposed between the umbelliferæ and the present group.

(4202.) The *Asterinæ* are so similar in structure, that a general conspectus may advantageously precede the statement of their chief differential characters.

Collectively considered, they are herbs or shrubs, rarely arborescent plants, with round or angled stems and branches, and exstipulate simple leaves, entire or often incised, but seldom really pinnate.

The inflorescence is capitulate, the calathi being for the most part many-flowered, rarely 1-flowered, and surrounded by an involucrum. The flowers are sessile on an enlarged common receptacle, similar or variable in form, and united, or by abortion separate.

The tube of the calyx is adnate to the germen, the epigynous limb forming a variable pappus, rarely being either foliaceous or absent. The corolla is epigynous, synpetalous, often deciduous, either regular or irregular, when regular being tubular with a 5-cleft limb, when irregular, either bilabiate or ligulate, staminiferous, and valvate in æstivation. The stamina are 5, exserted alternately with the lobes, opposite the primary longitudinal lines; the filaments are capillary and free, or monadelphous. The anthers are connate, rarely semi-connate, and very seldom free, linear and 2-celled, with an evident connectivum. The germen is unilocular, rarely subtrilocular, with 2 of the cells abortive and 1-ovuled. The style single, the stigmata 2, distinct, very seldom simple.

The fruit is for the most part a dry indehiscent akenopsis crowned by the limb of the calyx. The seed solitary, erect or inverted, albuminous or exalbuminous, the embryo straight, and the cotyledons foliaceous in germination.

(4203.) Hence, selecting the chief differential characters, the *Asterinæ* are epigynous synpetalous dicotyledons, or *Asterosæ*, with a capitate inflorescence, valvate æstivation of the corolla, 5 connate or semi-connate anthers (very rarely free), and a solitary ovule.

(4204.) Three modifications of structure or grades of development in the stamens, the union of which forms so peculiar a characteristic of this group, are noticeable in *Calycera*, *Xanthium*, *Aster*, and their respective allies. In *Aster*, the typical genus of the normal, and much the most extensive series, the anthers are decidedly and wholly connate, while the filaments are discrete, and the seeds erect and exalbuminous, or with the albumen very spare or evanescent. In the other two, which are the representatives of small and deviating groups, the anthers are either, as in *Xanthium*, discrete, the seeds being erect and exalbuminous; or, as in *Calycera*, only semi-connate, while the filaments are monadelphous, and the seeds pendulous, and furnished with fleshy albumen.

(4205.) Hence, were the union or discretion of the stamens the sole important diagnostic sign, three subsections might be distinguished, under the names of *Calycerianæ*, *Asterianæ*, and *Xanthianæ*. But *Xanthium*, the typical genus of the last of these speculative subdivisions, though distinguishable as above described from both of the preceding ones, has so many characters in common with the *Asterianæ*, and is indeed so similar to them in other important particulars, that, notwithstanding the disunion of its anthers, it does seem inexpedient, at least in our present state of knowledge, when the arrangement of the compositæ is in a very unsettled state, to introduce a speculative change, which would separate not only it and its more immediate allies, *Ambrosia* and *Franziera*, from their generally received connexions with the normal *Asterinæ*, but likewise render questionable the propriety of the location of *Kuhnia*, which is closely related to *Eupatorium*, as well as some more that might be mentioned. Another consideration, besides the further derangement of an unsettled order, induces me to retain the more generally established schemes of arrangement, and to let

Xanthium, and the other aberrant genera, be considered exceptions to the general rule, rather than as founding a separate subsection, viz. that in the various subdivisions of this extensive group there are, in the several grades of abortion in the florets, upon which the orders of the Linnean class syngenesia are founded, many approaches to such a condition as is confirmed in *Xanthium;* and of this *Tussilago hybrida* is a well known example, its casually distinct anthers being an anticipation of their constant disunion in the plants in question.

(4206.) Hence the systematic subsections of the *Asterinæ* are practically reduced to two, viz. the *Calycerianæ* and *Asterianæ*,

(4207.) The former, the *Calycerianæ*, being herbaceous *Asterinæ*, with alternate exstipulate leaves, subsyngenesious stamens, and pendulous seeds, with fleshy albumen;

(4208.) While the latter, the *Asterianæ*, are herbaceous or shrubby *Asterinæ*, with opposite or alternate exstipulate leaves, syngenesious stamens (rarely free), and erect exalbuminous or subalbuminous seeds.

CALYCERIANÆ.

(4209.) The three genera, *Boopis*, *Calycera*, and *Acicarpha*, are all that have been hitherto discovered which differ from the rest of the *Asterinæ*, in having monadelphous, subsyngenesious stamens, and pendulous seeds, with fleshy albumen. These therefore are alone included in this subsection, and they are all associated in a single type, which, from *Boopis*, has been named by Cassini the *Boopideæ*, and by Brown, from *Calycera*, the *Calycereæ*, which latter name, as it was the first given, is the one most generally received.

(4210.) Calyceraceæ. *Calycera*, and its typical allies, are herbaceous plants, with simple alternate leaves, entire or pinnatifid, and destitute of stipules.

The inflorescence is either terminal or opposite the leaves, capitulate, and many-flowered; the bracteæ of the involucrum are uniseriate, the receptacle paleaceous, the flowers sessile, uniform, and united, or with the central ones becoming stamineous by abortion.

The tube of the calyx is adnate to the germen, the limb epigynous, 5-parted, equal or unequal, and persistent. The corolla regular, infundibuliform, with a slender cylindrical tube and a 4-parted limb, the segments being linear, and each having 3 parietal nerves, one median, and the two others submarginal. The æstivation is valvate. The epigynous disk is obsolete; but, below the exsertion of the stamens and alternate with them, there are 5 nectareous or glandular areolæ. The stamens are 5, exserted from low down the tube of the corolla, and alternate with its segments; the filaments are monadelphous, and the anthers erect, linear, exappendiculate, connate by their lower halves, but free at their apices, 2-celled, with parallel locules, and dehiscent lengthwise by chinks, the connectivum being filiform and continuous with the filaments. The germen is inferior, 5-ribbed, the costæ extending to the laciniæ of the calyx, and 1-celled, the ovule solitary and pendulous, the style single, long, filiform, and glabrous, with the stigma simple and subcapitate.

The fruit (an akenopsis) is dry and indehiscent, and crowned with the rigid spiny persistent limb of the calyx. The seed is solitary and inverted, subsessile, and covered by a membranous testa. The albumen is thick and fleshy, the embryo cylindrical, straight, and axile, and the radicle superior.

(4211.) Hence, differentially considered, the *Calyceraceæ* are capitate epicorollous synantherous *Syringales* or *Asterinæ*, with semi-connate anthers, simple capitate stigma, solitary pendulous albuminous seeds, and alternate simple exstipulate leaves.

(4212.) The *Calyceraceæ* all belong to the warmer regions of South America. Their properties have not been hitherto investigated, and they are chiefly interesting from their forming the transitional grade between the *Dipsaceæ*, now excluded from the *compositæ*, and those types which are suffered still to retain that name; for, by their pendulous seeds and fleshy albumen, they agree with the *Dipsaceæ*, although they differ from them by their monadelphous stamens and subsyngenesious anthers, by which latter character they approach the *Asterianæ*.

ASTERIANÆ.

(4213.) The restricted Compositæ or *Synanthereæ*, excluding the *Dipsaceæ*, which were included by Ray, Vaillant, and the older writers, as well as the *Calyceraceæ*, the differential characters of which have not been very long made out, are equivalent to the *Asterianæ* of the present scheme. This name is proposed as a substitute for *Compositæ*, or at least as a synonyme, not only, as already observed, from the incorrectness of the older term, but likewise from the exceeding indeterminateness of its application: for, although by the majority of modern writers the word *Compositæ* is equivalent to our *Asterianæ*, by others, as by Bartling, it is extended so as to comprehend the whole of our *Asterinæ*, while, again, it must not be forgotten that it originally included a further portion of the *Asterosæ*, viz. the *Dipsaceæ* of Vaillant, or *Corymbiferis affines* of Ray.

(4214.) The subordinate distribution of the very numerous genera included in this subsection has engaged the attention of many botanists, and various schemes of arrangement have been advised. The most generally received is that adopted, with corrections, by Jussieu, from Ray and Tournefort; and, although the elaborate treatises of Cassini and Lessing are most valuable, for the extent and minuteness of their details; and the methods they have proposed in many respects admirable, for their ingenuity and philosophical acumen; still, as there are constant discrepancies between them, and as it is most probable that neither will be generally adopted without much further emendation, it would be premature to introduce either into a general elementary outline. The simplicity of the Jussieuan method still further recommends it; for its three groups, *Cichoraceæ*, *Corymbiferæ*, and *Cynarocephalæ*, are for the most part easily distinguishable; and, although some further subdivisions are desirable, still the majority of the schemes proposed do seem to be more than necessarily complex; thus Cassini establishes twenty different tribes, and Lessing eight, which are, however, immediately again divided into forty-eight.

(4215.) The *Cynarocephalæ*, *Corymbiferæ*, and *Cichoraceæ*, being as terms not quite unobjectionable, they have several times been changed, the first being called, from the thistle (*Carduus*), Carduaceæ; and the last, from the lettuce (*Lactuca*), Lactucaceæ, &c. But little advantage is gained by such alterations; and the principal change which seems to be necessary is that which will assimilate their terminations; hence, from the normal genera, *Cichorium*, *Aster*, and *Cynara*, they are here denominated *Cichoraceæ*, *Asteraceæ*, and *Cynaraceæ*: the term *Corymbiferæ* being abolished as incorrect, if applied to the inflorescence, and as an

irregular derivative from the name of an unimportant genus, if referable to *Corymbium*.

(4216.) The *Asterianæ*, collectively considered, are annual or perennial herbaceous plants, rarely becoming shrubs or small trees, with round or irregularly angled stems, and alternate or opposite, rarely verticillate leaves, usually simple and often entire, yet not unfrequently variously divided, and occasionally compound: always exstipulate, but with the petioles sometimes furnished with auricles resembling stipules.

The inflorescence is capitulate, the calathi being many-flowered (rarely by abortion 1-flowered, as in the *Rolandreæ* and *Echinops*), and surrounded by bracteæ in the form of an involucrum. The common receptacle is various in form, and either naked or covered by paleaceous or setaceous bracteolæ. The congested flowers, called floscules or florets, are either uniform or difform in each capitulum, the central part of which is called the disk, and the circumference the radius. The floscules are either united or separate, and often different in the same capitulum, so that they are frequently monœcious, or even diœcious and polygamous.

The tube of the calyx is strictly adherent to the germen, the limb epigynous and sometimes sessile, but often stipitate by the elongation of the tube, mostly paleaceous or pilose, rarely foliaceous, and very seldom abortive. The corolla is synpetalous, either regular and tubulose, or irregular and labiate; when the former, with a 5-cleft limb, which is valvate in æstivation; when the latter, either bi-labiate by the cohesion of the three petals or lobes of the limb to form an upper, and two to constitute a lower lip, or uni-labiate by the unilateral cohesion of all the lobes, when the corolla is said to be ligulate. The tube of the corolla is marked with 5 primary or sutural veins or costæ, alternate with the segments; these bifurcate below the divisions of the limb, and form two intromarginal costules that run within the edges of the segments, approach each other near the apex, and often unite and send back a common vein in the axis of the lobe. These recurrent nerves are called secondary: in some cases secondary or axial nerves are observed, which are not formed by the union and return of the primary ones. Both kinds of secondary costules are often absent, but the primary or sutural ones are universally present throughout the whole of the *Asterianæ*. The stamina are 5, exserted from the tube of the corolla, alternate with the lobes, and hence opposite the primary or sutural nerves. The filaments are free (rarely, as in the *Ambrosieæ*, monadelphous), the anthers narrow, 2-celled, connate, forming a tube, very rarely discrete, as in *Xanthium* and its allies. The connectivum is articulated with the filament, and often produced beyond the locules. The pollen is in angled or tuberculated grains. The germen is surmounted with an epigynous disk, 1-celled, rarely 3-locular, with two of the cells abortive. The ovule solitary and erect, attached to the lower part of the ovary; the style single, and the stigmata two, mostly discrete, rarely connate.

The fruit is inferior, dry, and indehiscent, *i.e.* a membranous, cartilaginous, or crustaceous akenopsis, crowned with the persistent limb of the calyx, which forms a pilose, plumose, or chaffy pappus, seldom being foliaceous. The seeds solitary, erect, and exalbuminous. The testa very thin, the tegmen fleshy, hence sometimes described as a thin albumen. The embryo is taper and erect, the radicle inferior, and the cotyledons entire, parallel, and epigean.

(4217.) Hence, selecting the chief differential characters, the *Asterianæ* are,

as before enumerated, epicorollous, capitulate, synantherous *Syringales* or *Asterinæ*, with solitary erect exalbuminous seeds, and an epigynous disk; the filaments being very rarely monadelphous or the anthers discrete.

(4218.) Like the *Angelicinæ* or *Umbelliferæ*, and several other natural groups possessing strongly marked differential characters, the *Asterianæ* or synantherous compositæ differ so little in their habit and more obvious external characters from each other, that the differential signs of their subordinate divisions are less striking than those groups where the general agreement is less. The diagnosis, however, is not the less satisfactory, although it is founded on considerations often more recondite and abstruse. Still the primary division of the *Asterianæ* into the types *Cynaraceæ*, *Asteraceæ*, *Cichoraceæ*, and *Mutisiaceæ*, is simple in theory, and its practical application in general easy in the extreme.

(4219.) The Asteraceæ, or *Corymbiferæ*, are biform *Asterianæ*, that is, have tubular florets in the radius, and usually ligulate in the disk. The receptacle not fleshy, and the stigmata continuous with the non-tumid style.

(4220.) The Cynaraceæ, or *Cynarocephalæ*, are regular uniform *Asterianæ*; that is, the florets are all tubular, both in the radius and the disk, the receptacle chaffy and often fleshy, and the style nodose, and hairy below the stigma.

(4221.) The Cichoraceæ are irregular uniform *Asterianæ*, that is, the florets are all labiate, both in the radius and the disk. The flowers are also united, the receptacle hardly fleshy, and the sap in general milky;

(4222.) While the Mutisiaceæ or *Labiatifloræ* are bi-labiate *Asterianæ*, *i.e.* of the five petals which are strictly conjoined to form the tube of the corolla two are more especially coherent to form a bifid upper lip, and the other three to form a tridentate lower one. The receptacle also is naked, and the leaves alternate, and sometimes cirrhiferous.

(4223.) The *Asterianæ* are variable in their properties, some being intensely bitter, others aromatic, and others narcotic; while in some, two or more of these properties are combined, especially the bitter principle with the aromatic and narcotic ones. In general, the *Asterianæ* are innocuous plants, and many of them afford wholesome food and useful medicines; but few, as the Leopard's banes, (*Arnicæ et Doronica*), are poisonous. The narcotic principle is chiefly prevalent in the *Cichoraceæ*, which are lactescent; the aroma prevails in the *Asteraceæ*, and the bitter principle, although present in both the other types, is more especially developed in the *Cynaraceæ*: so that from experience it would appear that the arrangement of Jussieu, founded on structural peculiarities, is greatly corroborated by physical properties.

(4224.) Asteraceæ or *Corymbiferæ*. *Xanthium*, *Franziera*, and *Ambrosia*, the most deviating of all the *Asterianæ*, are formed by Cassini and Lessing into a small group, called *Ambrosieæ* or *Ambrosidæ*; its peculiarities of coherent filaments and discrete anthers have already been noticed, and it may probably hereafter be established as a subtype of the *Asteraceæ*, if not even formed into a subsection of the *Asterinæ*, as already suggested.

(4225.) *Xanthium strumarium* is the lesser Burdock of the English herbalists, so called from its resemblance in habit, foliage, and inflorescence to the Arctium Lappa, or common Burdock. X. *spinosum* and *echinatum* are still more burry than the English species. The former is thought by some to be the *Xanthium*, an infusion of which Dioscorides affirms was once used to dye the hair of a yellow colour, whence indeed the generic name.

Franseria artemisioides and *ambrosioides*, formerly regarded as species of *Xanthium*, are chiefly remarkable for their arborescent port.

(4226.) The *Ambrosiæ* are not more comely plants than the *Xanthia*, but they are fragrant; and hence, as the Pagan divinities, although grosser than men in most of their attributed propensities, ate little solid food, but fed chiefly on odors, the poetical name of their viands has been given to these sweet-smelling weeds. *A. artemisiæfolia* is used in the Antilles as a febrifuge, and *A. maritima* has been commended for its cordial and tonic properties.

(4227.) *Iva frutescens* is the *Acapalti* of Mexico, where it is said to be so efficacious in the cure of intermittent fevers, that by the European settlers it is called *Mexican quinquina*.

(4228.) *Anthemis*, *Matricaria*, *Pyrethrum*, *Artemisia*, *Achillea*, *Tanacetum*, *Santolina*, *Chrysanthemum*, and *Diotis*, form, with other but less important genera, another of Cassini's tribes, included in the type *Asteraceæ*, and which he has called the *Anthemideæ*.

(4229.) *Anthemis nobilis* is the common or Roman chamomile, a popular and valuable aromatic bitter. It is much esteemed in infusion as a tonic, and used as an ingredient in fomentations. And Dr. Schall affirms, that it is not only an effectual preventive of nightmare, but the sole certain remedy for that complaint. It affords an essential oil of a fine blue colour when recently drawn, but which becomes yellow on exposure to air. The cultivated chamomile, in which the white radiant flowers are multiplied, and the yellow ones of the disk reduced, although a more sightly drug, is far less powerful as a medicine than that which grows wild, and in which the white florets of the radius are few, and the yellow ones of the disk abundant.

Anthemis Cotula (the *Maruta fœtida* of Cassini,) is the stinking chamomile. Notwithstanding its bad odor, it is often mixed with the true chamomile, which is likewise frequently adulterated with the *A. arvensis*, the flowers of which are inodorous, as well as with several species of *Matricaria*. *A. tinctoria* yields a good yellow dye.

(4230.) *Pyrethrum officinale* is the pellitory of Spain, once much esteemed as a sialogogue, and resorted to for the relief of toothach. The generic name, a derivative from πυρ, refers to the heat and acridity of the plant. Grew says, that when the root of pyrethrum is chewed, "it makes a sensible impression on the lips, which continues, like the flame of a coal, betwixt in and out, for nine or ten minutes, but the heat in other parts much longer, and the burning sensation thus produced is joined with a kind of vibration, as when a flame is brandished with a lamp-furnace."

The root contains a fixed butyraceous oil, rendered acrid by a peculiar essential one; and these, when extracted, have been found serviceable in cases of palsy, and in exciting cutaneous action when used as a liniment. The root has been recommended to be chewed in paralysis of the muscles of the tongue, and it has been employed as a stimulating bitter in low fever. Ainslie says, that its infusion is still administered in typhus by the Indian practitioners, who esteem it as a cordial and powerful excitant.

(4231.) *Pyrethrum* (or *Matricaria*) *Parthenium* is also aromatic and bitter, but far less potent than the preceding species. It was once a favorite remedy in ague, over which it was supposed to exert a specific influence; hence indeed its provincial name, *fever-few*, which is a corruption of *febrifuge*.

The odor of this plant is said to be peculiarly disagreeable to bees, and that these insects may be easily kept at a distance by carrying a handful of the flowers.

Matricaria Chamomilla and *M. suaveolens* are almost as fragrant as the *Anthemis nobilis*, for which indeed they are often substituted.

(4232.) The *Artemisiæ*, or wormwoods, are bitter aromatic plants, and several species have been used in medicine. *A. Absinthium* is the common wormwood; *A. Santonicum*, the *Tartarian* wormwood; *A. Abrotanum*, the southernwood; all of which, especially the first-named, are powerful anthelmintics. The seeds of the common wormwood are used by rectifiers to flavor spirits, and they are likewise employed in Scotland by distillers of great-still whisky. The flowers have also been used by brewers instead of hops, or added to the ordinary ingredients, to impart a more inebriating quality to the beer. *A. Dracunculus* is the Estragon, the young shoots of which form an excellent pickle, and are used to flavor fish-sauces and vinegar, hence called Tarragon. *A. Abrotanum* is said to be obnoxious to the larvæ of many insects, and it is therefore strewed in wardrobes to prevent clothes being destroyed by the moth. The seeds of *A. Contra* and *A. Judaica* have also been commended as anthelmintics and vermifuges, as well as the leaves and young shoots and flowers of *A. maritima, procera, campestris, arborescens*, and others. Indeed, several species, such as *A. glacialis, spicata, Vallesiaca, rupestris*, &c. which grow on the Alpine heights, nearing the confines of perpetual snow, are by the Swiss and other mountaineers much valued for their medicinal powers. They call these plants *Genepi*, and esteem them a panacea, each being the true genepi of different places, although the species are different in different localities. In Switzerland the genepi is used not only as a medicine, but as a condiment to flavor various kinds of food, and the liqueur called eau d'absinthe is impregnated with it. *Artemisia vulgaris* once was held in great repute as an emmenagogue; it was also steeped in baths, to lessen fatigue and invigorate the limbs. It is now chiefly valued for the downy substance that covers its leaves, which, like the pubescence of *A. Sinensis*, is collected, the coarser kinds being employed as amadou, and the finer used by surgeons as a convenient means of applying the actual cautery in a modified form, under the name of *Moxa*.

(4233.) *Achillea Millefolium*, the Millefoil, is slightly bitter and astringent; hence it has been employed as a vulnerary; but it is little esteemed, except by the good women of the Orkneys, who hold millefoil tea in high repute for its power of dispelling melancholy. *A. Ptarmica* is acrid, and has been used as a sternutatory and sialogogue. Several species of *Achillea*, such as *A. nana, atrata, moschata*, and *Herba-rota*, constitute the *Genepi* of various Alpine districts.

(4234.) The Tansy (*Tanacetum vulgare*,) is a strong-smelling, stimulating, bitter plant. It has, like its immediate allies, been commended as an emmenagogue and anthelmintic; and, notwithstanding both its smell and taste are to most persons very disagreeable, they are relished by others, and its leaves have hence been used to flavor puddings. Withering says, that if meat be rubbed with tansy leaves the flesh-fly will not touch it. A green colouring matter may be extracted from the shoots of the common tansy, which is used to dye their clothes by the Finlanders.

(4235.) *Diotis candidissima* is aromatic and very bitter; in the East Indies it is used as a diuretic. *Santolina Chamæcyparissia* is also an aromatic bitter, and so are the *Chrysanthema*, but they are more valued as ornamental plants than

for their medicinal virtues. The species are in general pretty, but the cultivated varieties of *C. Sinense* bear the most splendid flowers, and are, with the Dahlias, the chief pride of our gardens in autumn.

(4236.) Another group of the *Asteraceæ*, including *Inula, Pulicaria, Gnaphalium, Filago, Conyza, Baccharis, Buphthalmum, Sphæranthus, Helichrysum,* &c. &c. have been segregated by Cassini to form his tribe *Inuleæ.*

(4237.) *Inula Helenium* is the elecampane, by some persons esteemed as a grateful stomachic. Its leaves are aromatic and bitter, but its root much more so. The former were used by the Romans as potherbs, and it would appear were held in no mean repute, in after-times, from the monkish line, "*Enula campana, reddit præcordia sana.*" When preserved, it is still eaten as a cordial by Eastern nations, and the root is used in Europe to flavor certain sorts of confectionary that bear its name; and it enters into the composition of several of the continental carminatives. It is seldom used in England except in veterinary practice, or by fraudulent druggists to make an emetic powder, by the addition of tartrate of antimony, and then sold as a substitute for ipecacuanha. A peculiar proximate principle, something resembling starch, was first detected in the roots of this plant, and hence called *Inulin;* it has since been discovered in the tubers of the Jerusalem artichoke, the roots of the common pellitory, the Angelica, the bulbs of the colchicum, &c.

(4238.) *Inula* (or *Pulicaria*) *dysenterica* is a well-known native astringent bitter; it has been successfully used by the Russians in the cure of dysentery, whence its specific name; but in this country it is seldom if ever employed. *P. vulgaris* is the common flea-bane, so called from it, as well as the other species of *Pulicaria,* being obnoxious to vermin, and used to drive away fleas and gnats.

(4239.) The *Gnaphalia* of Dioscorides were plants with soft downy leaves, from which a substance was procured resembling cotton; and the present *Gnaphalia,* if not identical with the plants to which the name originally belonged, agree with them in their soft pubescent foliage. Their flowers are often pretty, and, from their natural dryness and imperishability, and the unchangeableness of their colours, they are commonly known, with the several species of *Helichrysum* and *Xeranthemum,* as 'immortals,' or everlasting flowers. They are very varied in colour, and form excellent winter beaupots. *G. dioicum* is mucilaginous as well as slightly bitter, and hence has been recommended as a demulcent in pectoral complaints. *G. arenarium* is said by the Portuguese physicians to be serviceable in dyspnœa; and Molina reports that *G. vira-vira* is employed in Chili as a sudorific and febrifuge.

(4240.) *Conyza squarrosa* is the common fly-bane, so called from its power of keeping off insects, especially flies, and of destroying fleas. It has also been used as a sudorific and emmenagogue. *C. alopecuroides* is reported to have diuretic powers; and two species, viz. *C. gummifera* and *C. robusta,* exude a gummy matter, which might be serviceable both in medicine and the arts. *C. odorata* is a fragrant plant; and *C. balsamifera,* which smells like the preceding, has been commended as a carminative.

(4241.) Several species of *Baccharis,* as *B. Indica, ivæfolia,* &c. are stimulating tonics; they are recommended to relieve headachs, and are sometimes employed to impregnate baths, and to make stimulating and resolutive fomentations.

(4242.) *Buphthalmum salicifolium,* the willow-leaved ox-eye, is said to possess

slight narcotic powers, thus anticipating the properties of the *Cichoraceæ*. Pallas says, that in Persia its leaves are used as tea, and that when infused the liquor resembles our ordinary beverage both in appearance and flavor: and Loureiro informs us, that in Cochin-China *B. oleraceum* is eaten as a potherb, although its leaves are too aromatic to be agreeable to a European palate. *Sphæranthus Cochin-Chinensis*, (one of the Cynaraceæ,) we are also told by the same authority, is much used in its native country as an emollient; and several more of the *Inuleæ* might be employed as food or medicine, but those which have been enumerated are the most powerful and important.

(4243.) The *Astereæ* of Cassini, including *Aster*, and its more immediate allies, *Callistemma*, *Erigeron*, *Solidago*, and *Bellis*, are more ornamental than useful plants. The Asters are favorite garden-flowers, familiarly known as Michaelmas daisies; *Callistemma hortensis*, of which there are many varieties, is commonly called the China Aster, or Starwort. *Solidago* is the golden rod; of it there are several handsome species, some of them, as *S. fragrans*, being sweet-scented. And, although often too much neglected, the humble daisy (Bellis) must not be passed unnoticed. Most of these plants are slightly astringent, hence the roots of the daisy and of the golden rod have been used as vulneraries; and *Erigeron Philadelphicum*, which is very fœtid, is affirmed to be a powerful emmenagogue. The ashes of *Erigeron Canadense* and *E. acre* yield 5-6 per cent. of vegetable alcali; and the latter plant, with *Aster acris*, are perhaps the most active of the group.

(4244.) Of the *Senecioneæ* of Cassini, including, besides the normal genus, several other Asteraceous plants, few or none are known to possess any important medicinal properties, or to be applicable to economical purposes. *Cacalia procumbens* is said by Loureiro to be eaten as a potherb by the Cochin-Chinese; and *C. sonchifolia* and *C. bulbosa*, as well as several species of *Senecio*, especially *Jacobæa* and *Vulgaris*, have been made into emollient poultices, but their use is limited, and their virtues questionable. They are generally regarded as troublesome weeds; and the chief consumption of the latter is as green food for birds, under the name of groundsel; when beaten to pulp, and applied as a poultice to the pit of the stomach, it is said to provoke nausea and vomiting. *S. vulgaris* is principally interesting from the abortion of its radiant flowers, by which a connexion is established with the *Cynaraceæ;* and hence the non-tumid style becomes here an essential diagnostic sign.

(4245.) *Arnica*, which is the normal genus of Cassini's tribe *Arniceæ*, is remarkable for the anomaly which it and its immediate associates, the *Doronica*, introduce into the history of the properties of the natural families to which they belong; for, amongst so many wholesome and aromatic plants, altogether innocuous, if not esculent, these are said to be very deleterious. *Doronicum Pardalianches* is the common Leopard's bane; and its roots, like those of *D. scorpioides* and *D. plantagineum*, are reputed to be acrid poisons. *Arnica montana*, the mountain-tobacco of the French, is affirmed to owe its noxious properties to the presence of Cytisine, that peculiar proximate principle which renders the seeds of the Laburnum poisonous; a plant which, like the present, is naturally connected with many that are altogether innocuous. It would seem, from modern experiments, that the virulence of *Arnica* has been not a little exaggerated, and its medicinal powers have perhaps been magnified also; for the reports of its efficacy in the cure of putrid fever, ague, palsy, amau-

rosis, &c. &c. but little accord with the neglect into which it has generally fallen. On the Continent, however, it was always more in esteem than here; and in Germany it even received the name of *Panacea lapsorum*.

(4246.) *Eupatorium*, *Adenostyles*, and *Tussilago*, the normal genera of Cassini's three tribes, *Eupatorieæ*, *Adenostyleæ*, and *Tussilagineæ*, are asteraceous genera, although, like several of the other modern tribes, they contain plants which do not belong to the Jussieuian *Corymbiferæ*, the present *Asteraceæ*. Very few of them are remarkable for their medicinal properties, or the economical purposes to which they have been applied. *Tussilago Farfara*, the coltsfoot, is a demulcent bitter, and has been employed to sooth irritation in the air-passages, and hence its reputation as a pectoral medicine. Its leaves have also been smoked to relieve dyspnœa. They have likewise been used as stuffing for pillows and cushions; and their down, when saturated with saltpetre, makes excellent tinder. *Eupatorium aromaticum* and *E. odoratum* have very fragrant roots; and *E. cannabinum*, *perfoliatum*, *satureiæfolium*, &c. are so bitter that they have been employed as febrifuges. *E. Aya-pana* has been much extolled in Brazil as a diuretic and diaphoretic, *E. perfoliatum* for renal diseases, and *E. rotundifolium*, as useful in consumption; but none have enjoyed so high, and apparently so undeserved a reputation, as the *E.*, now called *Mikania Guaco*, which the South Americans affirm to be an antidote to the bite of poisonous serpents, and which it was once hoped might have proved serviceable in that formidable disease, *hydrophobia*. *Liatris scariosa* and *L. squarrosa* are said to be powerful diuretics; and *Stevia febrifuga* is much valued in Mexico as a remedy in intermittent fevers.

(4247.) *Helianthus*, *Tagetes*, *Calendula*, and *Arctotis*, are four other *Asteraceæ*, which give name to the Cassinian tribes *Heliantheæ*, *Calenduleæ*, *Tagetineæ*, and *Arctotideæ*. Neither of the latter contain any officinal plants, although some, as *Coreopsis*, *Dahlia*, *Tagetes*, &c. are very ornamental; and *Euxenia* is remarkable as affording another instance of the anthers being discrete. *Helianthus annuus* is a splendid shrubbery flower; its seeds are also very nutritious food for poultry. In North America they are made into cakes and bread by the Indians, and from them an excellent oil may be extracted. The pith of the sunflower consists of almost pure medullin.

The roots of *H. tuberosus* are esculent; they have much the flavor of the artichoke, and hence the plant has been called by the Italians *Girasole articiocco*, of which our vulgar name, 'Jerusalem artichoke,' is a vile corruption.

(4248.) The roots of the *Dahliæ*, although fleshy, and abounding in farina, have so disagreeable a flavor as not to be esculent; but their splendid blossoms make amends for their unsavory roots.

(4249.) *Calendula officinalis* is the common Marigold, which at one time was much employed as a carminative. Its use has, however, now become almost obsolete, and its chief consumption is to adulterate saffron, and by dairy-maids to give a rich colour to their cheese and butter.

(4250.) Both the British species of *Bidens*, *B. tripartita*, and *cernua*, are very acrid plants; when chewed they excite salivation; they have also been used as yellow dyes.

(4251.) Cynaraceæ, or *Cynarocephalæ*. Several of the genera, and sometimes, as in Senecio, deviating species of genera, the majority of which have all the characters of *Asteraceæ*, abort the radiant florets, so that the heads of in-

florescence assume the general appearance of the *Cynaraceæ*, and are only distinguishable from the present type by their non-tumid styles.

In the illustrations given, it will also have been noticed, that although the principal genera of the Cassinian tribes were included in the *Asteraceæ*, others are associated with them that belong to the present type, thus shewing the intimate relationship of the two; for by Cassini, Lessing, and others, the Jussieuan distribution is neglected as incompatible with their systems, which are not merely schemes for the further subdivision of the older groups, but plans proposed for an entirely novel demarcation of the whole of the *Asterianæ*. But, like the preceding type, the present comprehends more or less completely several of Cassini's tribes, and hence they will be mentioned as examples, and cited in illustration.

(4252.) *Echinops, Carduus, Centaurea,* and *Carlina,* are the four normal *Cynaraceous* genera which give their names to the four Cassinian tribes, *Echinopsidæ, Carduidæ, Centauridæ,* and *Carlinidæ.*

(4253.) *Echinops,* the globe-thistle, is the only genus included in the first-named of Cassini's tribes or subtypes. The generic name refers to the prickles with which the heads of inflorescence are thickly beset. *Echinops sphærocephalus* is reported to possess sudorific and cathartic properties, and is used in Languedoc as a remedy in rheumatism. Amadou is prepared from the woolly leaves of *E. strigosus,* which are employed in Spain as a substitute for tinder.

(4254.) Of the *Carduidæ,* which are in general scentless non-lactescent plants, with very bitter juices and spiny leaves, the genera *Carduus, Cirsium* (or *Cnicus*), *Arctium, Onopordum, Cynara, Silybum, Serratula,* and *Carthamus,* are the most familiar and important examples.

(4255.) *Carthamus tinctorius* is the base saffron, often used to adulterate the genuine drug. It is also employed as a dye-stuff to tinge silk and cotton goods, and to make the vegetable rouge, so much in request by those who resort to the aid of such cosmetics. The markets are chiefly supplied with this drug from the Levant, especially from Egypt. Its seeds have been used in medicine, and they are said to form by trituration with water an agreeable aperient emulsion. They are also eaten by many birds. *C. lanatus* is bitter, and has been so much extolled as a febrifuge, that it enjoys, along with *Centaurea benedicta,* the name of the "blessed thistle."

(4256.) *Arctium Lappa* is the common burdock. In the North of Europe its roots and young shoots are eaten as potherbs, and in France its buds, when cultivated after the manner of asparagus, form a very palatable food, and make a good substitute for the more delicate vegetable. Its seeds, which are bitter and slightly acrid, have been used as diuretics; a decoction of the root forms one of the French pectoral ptisans; it has also been recommended as a detergent wash to cleanse foul ulcers, and as a remedy for herpetic affections. Sir Robert Walpole praised it as gout medicine, and others have considered it an excellent substitute for sarsaparilla.

(4257.) *Cynara Scolymus* is the common artichoke, and *Cynara Cardunculus* the cardoon, both of which are cultivated for culinary purposes, the parts eaten being the fleshy bases of the bracteæ or scales of the involucrum, and the enlarged succulent common receptacle. They have a very delicate and agreeable flavor, and are much esteemed, either when plainly boiled, or as an ingredient in ragouts, fricassees, and soups. The young shoots, when earthed up like celery and blanched, form a very good winter vegetable. The artichoke has been used medicinally as

a stomachic, and its flowers, as well as those of the cardoon, were once commonly employed by the Portuguese instead of rennet to curdle milk. The artichoke is also said to afford a good yellow dye.

(4258.) *Onopordum Acanthium*, the wild artichoke, or Al-cachofa of the Spaniards, has, like the *Cynaræ*, a fleshy receptacle, which is esculent. It was once cultivated as a dietetic vegetable, but has been wholly superseded by *C. Scolymus* and *Cardunculus*. The expressed juice of this plant is said by Eller to be a serviceable application to cancer of the breast and to cleanse foul ulcers, and a decoction of its root, which is astringent, has been used to restrain discharges from the mucous membranes. Its seeds, as well as those of *O. Illirycum*, *Arabicum*, &c. are oleiferous; M. Durand reports, as the result of much experience, that 22 lbs. of the onopordum heads yield 12 lbs. of seeds, from which 3 lbs. of oil fit for burning may be expressed by the aid of heat.

(4259.) Most of the common thistles belong to the genera *Carduus* and *Cirsium* or *Cnicus*, a few only being separated to form the genera *Silybum* and *Carlina*. The *Cardui* are in general bitter and febrifugal plants, but are rarely used medicinally. *C. nutans* is the musk-thistle, remarkable for its fragrant flowers. *Cirsium* or *Cnicus* (the old Serratula,) *arvense* is noticeable for bearing galls in the axillæ of its leaves, which are said to be powerfully astringent, and to be useful as styptics in restraining hæmorrhage, and in relieving hæmorrhoids; but it need not be insisted on, that if they are beneficial in the latter case, the sufferers must not be content with carrying them in their pockets, as our old wives command. The roots of *Cnicus tuberosus* are fleshy, and, from the quantity of fecula they contain mingled with a bitter principle, tonic and nutritious, and hence they have been recommended as a light wholesome diet for consumptive patients. The milk-thistle (olim *Carduus, dein Cnicus, nunc*), *Silybum Marianum*, is a noble plant. It is the species most commonly referred to as the

> "Proud thistle! emblem dear to Scotland's sons,
> Begirt with threatening points, strong in defence,
> Unwilling to assault."

And well does its towering height, wide spread pearly foliage, and generally majestic port, justify the poet's grand apostrophe. Some persons, however, believe that *Carduus acanthoides* is the true Scotch thistle; a plant of which Messrs. Dickson and Gibbs, nurserymen, near Inverness, raised in their grounds a few years ago to the astonishing height of eight feet, thus seeming for a moment to furnish evidence in favor of Foote's illnatured and pricking satire, that "nothing grows to perfection in Scotland but thistles, and those are raised in hotbeds."

The leaves of *S. Marianum*, when mature, are said to be possessed of sudorific and aperient powers; when young, the leaves and leaf-stalks are boiled and eaten as greens.

(4260.) Of the *Serratulæ* or saw-worts, several species have or might be used for economical or medicinal purposes. *S. Scordium* is said by Loureiro to be esteemed in India as an emmenagogue and diaphoretic. *S. amara* is remarkable for its intense bitterness; the leaves of *S. oleracea* are eatable; and *S. tinctoria* yields a fine yellow colour, which, as a dye, is much more durable than either the yellow-woad or broom. Comparatively few animals feed on thistles. The ass is one of the few that seem to relish them, their spines being probably only an agreeable stimulus to his hardened palate, and standing in the stead of spice or

other condiments; and hence some of these plants have received the generic name of *Onobroma*.

(4261.) *Centaurea* (sometimes subdivided into several genera or subgeneric groups,) has been made by Cassini the normal genus of his tribe *Centaurieæ.* They are bitter non-lactescent plants; one, the *C. benedicta,* the true blessed thistle, was once much used as a febrifuge; and, although now neglected, its properties are such as to lead to the belief that it has been superseded by other not more efficacious remedies: its chief fault being the ease with which it may be obtained; for with too many persons the difficulty of procuring, the distance it must be fetched, or the exorbitant price, are considered to be essential pre-requisites to the successful operation of a medicine: if they are told to do some great thing they are ready to do it, but turn away in a rage, when only bidden to wash and be clean. *C. lanata* (the *Carthamus lanatus* of Linneus,) has properties similar to the foregoing species [vide § 4255], and in France is known by the same common name of *Chardon béni*. *C. Behen, Jacea, Calcitrapa, Centaurium,* and other species, have been used as febrifuges; indeed, the last-named has been preferred to gentian, and many of the more powerful bitters. From *C. Cyanus* a delicate blue colour may be extracted, which is valued as a pigment by miniature painters.

(4262.) *Carlina,* another of the *Cynaraceæ,* gives its name to Cassini's tribe *Carlineæ*. It is a small group, and the plants it contains are almost as insignificant in properties as they are in number. *Carlina vulgaris* was once much extolled for alexipharmic powers. *C. caulescens* and *C. acaulis* have likewise not lacked laudations, but they have wholly fallen into disuse, notwithstanding the older herbalists affirm that the latter was pointed out by an angel to the Emperor Charlemagne as the means by which to cure his army of the plague: from which incident the old records add that the genus received its name. The flower is large and handsome, and being, like the other 'immortals,' little subject to decay, it is often fixed against the cottage-doors in Germany, France, and Spain, by way of a hygrometer, as it regularly closes before rain. In the mountainous parts of Dauphiny the fleshy receptacle of *C. acanthifolia* is eaten as a substitute for the artichoke.

(4263.) Mutisiaceæ. The labiate Compositæ of Europe are all unilabiate, *i. e.* have ligulate or 1-lipped, and not ringent or 2-lipped corollæ. But in South America, about the Straits of Magellan, the unilabiate genera are superseded by a very remarkable group, in which the corolla is bilabiate. These have been distinguished by De Candolle from the three ordinary Jussieuan orders, and called, from their peculiar structure, *Labiatifloræ:* a very exceptionable name, because it is used by Bartling to designate the true *Labiatæ* and their allies, and to which, if to any, it of right belongs. Hence the term must be cancelled, although the demarcations of the group and its distinctive characters may be at once admitted; and Cassini having designated it, from the normal genus, *Mutisia,* this nomenclature, being according to rule, will most likely be universally received.

(4264.) The *Mutisiaceæ,* or bilabiate Compositæ, are placed by De Candolle between his *Cynarocephalæ* and *Cichoraceæ,* and they certainly seem to be transitional from the one of these series to the other, notwithstanding they likewise exhibit important resemblances to the *Asteraceæ*. But as, notwithstanding their labiate corollæ, by which they would seem to establish a connexion with the

ligulate Cichoraceæ, they are non-lactescent, and their florets are often radiate and dithalamous, it seems advisable to regard them as a distinct and separate type, at least for the present, until their affinities may be further investigated and more completely understood.

(4265.) Hence the *Mutisiaceæ* or *Labiatifloræ* are bilabiate *Asterianæ*, with the upper lip bifid, the lower one 3-toothed: the head of inflorescence often radiate, the leaves alternate, sometimes cirrhiferous, and the juices bitter, but not lactescent.

(4266.) Very few genera belonging to this group have been as yet discovered; and of those which have been described there is little or nothing of real importance known. *Trixis divaricata* or *Perdicium Braziliense* has a strong smell, and is so astringent that it has been used in decoction in Brazil in cases of menorrhagia. *Chuquiraga insignis*, which is a native of Peru, is bitter, and has been reported by Lessing to be considered in Payta a valuable medicine in ardent fevers. The other genera, from their apparent relationship to the *Cynaraceæ*, are probably likewise bitter and febrifugal.

(4267.) Cichoraceæ. The succory-like plants, which are all included by Cassini in his single tribe *Lactuceæ*, have been distinguished by Don and Lessing into several (6 or 7) subtribes, which, from *Hieracium*, *Lactuca*, *Scorzonera*, *Hypochœris*, *Hyoseris*, *Lampsana*, and *Scolymus*, have been called by the latter author *Hieracieæ*, *Lactuceæ*, *Scorzonereæ*, *Hypochœrideæ*, *Hyoserideæ*, *Lampsaneæ*, and *Scolymeæ*.

(4268.) The *Cichoraceæ* are in general very juicy, if not succulent plants, and their sap is for the most part milky. Some of them are slightly astringent, and others bitter, but their narcotic properties form their more common and remarkable characteristic. This sedative principle, which is most developed in the lettuce, has hence been called *lactucarium*, but it does not naturally exist in any species in sufficient relative proportion to the mild mucilaginous constituents to render them poisonous. The deleterious properties of the *Lactuca virosa*, which might seem to contradict this generalization, are attributable to a superadded acridity, and not to the *lactucarium* it contains. The *Cichoraceæ* are furthermore less bitter than either the *Cynaraceæ* or the *Asteraceæ*, and they are destitute of the fragrance of the latter: for, although their seeds contain a mild fixed oil, easy of extraction and useful for economical purposes, those various modifications of essential oil which give to the different *Asteraceæ* their peculiar odors, and often very stimulating flavors, are wholly absent. The *Cichoraceæ* are hence in general innocuous plants, and many of them form wholesome dietetic vegetables, when by culture their bitterness is lessened and their succulence increased. One other agreement among the *Cichoraceæ* demands notice, and the more especially as it is an exception to the general rule, that lactescent plants contain caoutchouc in their sap, their milky juices being wholly destitute of this peculiar principle. The natural emulsions of these vegetables seem to be formed simply by the diffusion of a fixed oil through water, which is suspended by a little mucilage, and hence, unless the observation of Valentine on *Sonchus floridanus* be confirmed by future experiments, the milky sap of the *Cichoraceæ* must be regarded as devoid of caoutchouc.

(4269.) *Scolymus*, which gives name to Lessing's subtype *Scolymeæ*, originally belonged to the artichoke (*Cynara Scolymus*); it however now is given to the

golden thistles. *S. Hispanicus* has a sweet fleshy root, which is eaten by the Spaniards; the leaves and stalks are also esculent, and form a common vegetable in the markets of Salamanca. The flowers of the golden thistle, like those of Carthamus and Calendula, are employed to adulterate saffron.

(4270.) *Lampsana* or *Lapsana,* the nipple-wort, is the normal genus of Lessing's subtribe *Lampsaneæ,* which consists almost entirely of the three modern genera, *Lampsana, Rhagodiolus,* and *Koelpinia,* into which the old genus *Lapsana* has been divided. *Lapsana communis* has obtained some reputation in village medicine as a soothing application to inflamed nipples, and it is in some of our provinces frequently used to allay the irritation brought on by nursing, and hence its common name.

(4271.) *Cichorium,* the succory or endive, and *Hyoseris,* the swine's succory, with *Arnoseris,* the lamb's lettuce, and other similar plants, form Lessing's subtribe *Hyoserideæ* or *Cichoreæ.* They are all esculent, but two species of the first named are the only ones employed as human food. *Cichorium Intybus* is cultivated on the continent for the sake both of its leaves and root: the latter, when roasted, is used instead of coffee; and, although it was first employed either to adulterate the Mocha drink, or as a poor substitute for it when the berry was too expensive for general consumption, its use is now established, and, when mixed with coffee, it is by some persons believed to improve its flavor. The roots of the succory, if stowed between strata of earth in a warm cellar, the crowns being alone left exposed, will shoot out their leaves freely during the winter, and these, from their being kept in the dark, are blanched, and form an excellent salad. This mode of forcing is carried on extensively in France.

The endive (*Cichorium Endivia*) is an allied species, or, as some affirm, a mere variety of *C. Intybus*: it is grown in abundance in the neighbourhood of London, and is one of our favorite winter salads. The succories form excellent food for cows, increasing, it is said, very materially the quantity of milk that they afford.

(4272.) *Hypochoeris, Seriola, Robertia,* &c. which form Lessing's subtribe *Hypochærideæ,* are plants of little economical importance. Swine are said to be fond of the roots of *Hypochoeris radicata,* the long-rooted cat's-ear, whence indeed its generic name.

(4273.) *Scorzonera, Leontodon, Apargia, Tragopogon,* &c. which form Lessing's subtribe *Scorzonereæ,* are most of them eatable plants. *S. Hispanica* is the viper's-grass or Spanish salsafy, once celebrated as an antidote for the bite of the viper, but now merely used as a dietetic plant, the roots being fleshy, and something resembling those of carrots and parsnips, or rather the *Tragopogon porrifolius,* which is the true or garden salsafy. The flavor of the boiled roots of this latter vegetable is very like that of asparagus; it is too little grown in British gardens, but on the continent it is very commonly seen. The roots of *T. pratensis,* the goat's-beard, are equally good as food, and by some persons preferred to the preceding.

(4274.) *Leontodon Taraxacum,* the dandelion, has sometimes, when blanched, been introduced on our tables in salad, but its bitterness is too powerful to allow it to be a pleasant food. It is hence more in repute as a medicine, and in the hepatic complaints of persons long resident in warm climates it often affords very marked relief. It is tonic, and promotes the various secretions, forming likewise an excellent food for milch cows; and, from its influence over the excre-

tions of the kidnies, probably arose its vulgar name, which is found identical in several languages. Its roots, like those of the succory, have been roasted and used as a substitute for coffee. This practice is common among the poor at Gottingen.

(4275.) The lettuces, as their generic name, *Lactuca*, hints, abound with a milky sap. This, which, when the plants are young or the leaves excluded from the light, is of a mild and pleasant bitter, and but very slightly narcotic, becomes, in the old stems and foliage, and more especially in those plants which are fully exposed to the sun, extremely bitter and notably sedative. In some species, as *L. virosa*, *elongata*, and *sylvestris* or *scariola*, the narcotic principle is more predominant than in *L. sativa*, *crispa*, *quercina*, *perennis*, &c. which are alone cultivated for food, the others being uneatable, if not absolutely poisonous. The lettuce has been long in cultivation, and its soporific properties were very early known. A bed of lettuces was feigned by the poet as being able to induce sleep even in a love-distracted mind, and restless persons have often found a lettuce supper very conducive to repose. The extract of lettuce is admitted into our lists of medicines, and it is found to be a serviceable mild narcotic, and its administration not to be followed by the depressing and distracting symptoms which so often attend the exhibition of opium. There are many varieties cultivated in our gardens, and, like other long domesticated plants, their genealogy is lost in the obscurity of ages. Thus some persons suppose them all to be variations of *L. sativa*, while others believe even *L. sativa* itself to be only an ameliorated form of *L. scariola* or *quercina*; and not a few authorities refer to *L. virosa* as the original stock.

(4276.) Of *Crepis*, *Barkhausia*, *Sonchus*, &c. little need be said. The former are too bitter for human food, and, although by the poor peasants in Germany and France the leaves of the latter are sometimes eaten as salads, they are more commonly used as food for swine than men.

(4277.) The *Hieracia* or hawk-weeds, which, with a few other insignificant plants, form Lessing's subtribe *Hieracieæ*, are chiefly interesting from the difficulty which is found in distinguishing the very numerous species of the normal genus. Some of them have handsome flowers, and are well worthy of cultivation for ornamental purposes. *H. murorum* is one of the lung-worts, so called from the supposition that it possessed the power of curing consumption; a belief as groundless as the apparently more absurd opinion, that the juice of another species is used by hawks to strengthen their eyes, and enable them to see their prey at almost any distance.

ERICOSÆ.

(4278.) The Heaths (Ericæ), with the few other plants that agree with them in having perigynous, synpetalous, staminiferous corollæ, were associated by Jussieu to form his ninth class, named by Richard *Pericorollæ*, but which is here, from the normal genus, *Erica*, called the *Ericosæ*. By De Candolle, who combines the epigynous and perigynous polypetalous Exogenæ, that is, the *Myrtosæ* and *Angelicosæ*, which form together the polypetalous portion of his suborder Calycifloræ, (§ 1917, 3356,) the epigynous and perigynous monopetalæ, that is, the *Asterosæ* and *Ericosæ*, are likewise united; all those plants in which the stamens and petals do not either separately or in union arise from the receptacle

being considered calyciflorous. This scheme has some advantages to recommend it, as the distinctions are in general more obvious between the hypogynous exsertion of the stamens and corolla, and the two other modes, than these latter, the perigynous and epigynous, are from each other. But as the distinctions fail on either hand, there does not seem to be any sufficient reason for such a deviation from the Jussieuan scheme: and this the more especially as the synpetalous *Asterosæ* and *Ericosæ,* with their staminiferous corollæ, appear to be more nearly related to the synpetalous *Primulosæ,* whose corollæ are likewise staminiferous, than to the epigynous and perigynous *Angelicosæ* and *Myrtosæ,* which are the polypetalous calycifloræ of De Candolle. Hence the original plan is here retained with sufficient explanation of the change proposed by De Candolle to render his scheme consentaneous with the present, by the union of the subdivisions adopted from Jussieu.

(4279.) Collectively considered, the *Ericosæ* are synpetalous perigynous Exogenæ, with often staminiferous corollæ, or, in other words, pericorollous *Syringales.*

(4280.) The three sections into which this suborder is divided are called, from *Campanula, Erica,* and *Styrax,* the normal genera of each, the *Campanulinæ, Ericinæ,* and *Styracinæ.*

(4281.) The *Gesneriaceæ,* included in his ninth class by Jussieu, are more nearly related to the *Orobanchaceæ* and *Cyrtandridæ* of the hypocorollous *Primulosæ,* than to either of the present sections, notwithstanding the germen is occasionally half inferior; for the calyx being more or less adnate, merely indicates them as the transitional group from one suborder to the other, just as similar modifications of structure have shewn the connexion of other series; *e. g.* the hypogynous *Mimosas,* (§ 2220,) amongst the perigynous or calyciflorous *Myrtosæ,* the subhypogynous *Vitinæ,* (§ 3480-3,) amongst the thalamiflorous Rhæadosæ; the questionable form of Eschscholtzia, (§ 3833,) and the epigynous corolla of the *Vacciniaceæ,* which, notwithstanding, cannot be severed from the *Ericaceæ* and *Epacridaceæ.*

CAMPANULINÆ.

(4282.) The genera included in this section are distributable into three types, called, from *Goodenia, Stylidium,* and *Campanula,* the *Goodeniaceæ, Stylidiaceæ,* and *Campanulaceæ.*

(4283.) Collectively considered, the *Campanulinæ* are pericorollous *Syringales* or *Ericosæ,* with the calyx in general adnate to the germen and corolliferous, hence the corolla is perigynous; it is also for the most part staminiferous, the stamens being equal or less in number than its lobes, and alternate with them. And the placentæ central and polyspermous.

(4284.) Goodeniaceæ. *Goodenia,* and its typical allies, are herbs or shrubs, with watery juices, round or irregularly angled stems, alternate simple leaves, entire or occasionally lobed, often dentate, and always destitute of stipules.

The inflorescence is variable, scattered, or more rarely aggregate; and the flowers for the most part irregular and united.

The calyx is adnate to the germen, rarely free, persistent, equal or unequal, 5-cleft or 5-3 lobed, with the limb sometimes shortened and entire, or even obsolete. The corolla is exserted from the faux of the calyx, synpetalous, more or less irregular, deciduous, or marcescent; the tube with a posterior longitudinal cleft,

or sometimes, when the calyx is nearly free, 5-cleft, and adherent to the base of the germen. The limb is 5-parted, 2 or 1-lipped, the disk of the segments being flat, the sides or wings attenuated, elevated, and with an induplicate æstivation, rarely obsolete or absent. The stamens are definite (5), perigynous, distinct from both the petals and the style, and alternate in exsertion with the lobes of the corolla. The filaments are free, the anthers free or coherent, linear, erect, 2-celled, with contiguous parallel locules, and dehiscent lengthwise by chinks. The pollen simple or compound. The germen consists of 2 connate carpels, 2 or 1, rarely 4-celled. The placentæ central, the ovules in general many, seldom definite; the style single, (rarely divided,) the stigma entire, (seldom 2-lobed,) and surrounded by a submembranaceous cup-shaped indusium, which is either entire or two-lobed.

The fruit is a polyspermous capsule, 2-, rarely 4-celled, or occasionally 1-celled by the shortening of the dissepiment: sometimes, but seldom becoming drupaceous, and very rarely a 2-seeded utricle. The seeds are erect, the testa often thickish or subosseous, the albumen fleshy and of the shape of the seed, seldom wanting. The cotyledons of a median size, often foliaceous, and the plumula inconspicuous.

(4285.) Hence, differentially considered, the *Goodeniaceæ* are non-lactescent *Campanulinæ*, with an irregular or subregular corolla, the margins of the lobes induplicate in æstivation, and the stigma indusiate.

(4286.) *Brunonia* and *Scævola*, associated with the *Goodeniæ* by Dr. Brown, have been separated by other systematists, and made examplars of distinct orders. These genera differ from the other *Goodeniaceæ* in several particulars, but it seems sufficient to regard them as subtypes; hence the *Goodeniaceæ* may be divided into three subordinate groups, the *Brunonidæ*, *Scævolidæ*, and *Goodenovidæ*.

(4287.) In the first, the *Brunonidæ*, the inflorescence is capitate, the corolla nearly regular, the fruit a superior 1-celled membranous utricle, enclosed within the indurated tube of the calyx, and the seed solitary and exalbuminous;

(4288.) While in the *Scævolidæ* the fruit is drupaceous or nut-like, inferior, 1-2-4 celled, with 1-2 seeds, and the albumen fleshy;

(4289.) And in the *Goodenovidæ* the capsule is 2-4 celled, and the seeds indefinite and albuminous.

(4290.) The *indusium*, or cup-shaped process of the style which surrounds the stigma, is the most peculiar characteristic of the *Goodeniaceæ*, and it prevails in all the three subtypes. It is probably a modification of the hairy processes common in the *Campanulaceæ*, and which become verticillate in *Lobelia*, so as to constitute a cyathiform fringe, the pile of which only requires cohesion to produce the indusium, so characteristic of this type. *Brunonia*, by its capitate flowers, establishes a connexion with the compositæ, which is corroborated by what Dr. Brown very truly calls "the remarkable joint or change in texture in the apex of its filaments." This genus is likewise further noticeable for its free or superior germen and hypogynous stamens, as well as for its 1-celled ovary and solitary exalbuminous seed. *Scævola*, which agrees with *Brunonia* in having sometimes a 1-celled fruit and solitary seed, and with the *Goodenovidæ* in its inferior germen and fleshy albumen, is evidently the connecting link between these two extremes, with the latter of which the *Scævolidæ* are still in general combined. The *Goodenovidæ* are peculiarly interesting from the extraordinary modifications of

their floral organs, the calyx being sometimes inferior, while the corolla is superior, thus, as in various other instances, setting at naught the artificial characters of natural orders.

(4291.) The *Goodeniaceæ* being natives of New Holland and the South Sea Islands, are less familiar to Europeans than many other tribes, and their uses and properties are as yet unknown.

(4292.) STYLIDIACEÆ. *Stylidium* and its allies, *Leuwenhockia* and *Forstera*, which form together this small type, are herbs or shrubs, with aqueous juices, round stems and branches, or sometimes with the general axis abortive and be-

Stylidium laricifolium.

B. Cutting, to shew leaves and inflorescence.

(*a*) Entire flower.

(*b*) Section of ditto, to shew the cohesion of the stamina and style, forming a column.

(*c*) Transverse section of the ovary.

(*d*) The entire fruit.

(*e*) Section of the same.

(*f*) A seed (magnified.)

(*g*) Longitudinal section of ditto, to shew the albumen and included embryo.

coming scapescent. The leaves are alternate, seldom verticillate, simple, entire, plane, and exstipulate.

The inflorescence is terminal, (seldom axillary,) and either solitary, spicate, or racemose, the pedicels often tri-bracteate, and the flowers united and mostly irregular.

The tube of the calyx is adnate to the germen, the limb 2-6 parted, bilabiate or regular, and persistent. The corolla synpetalous, with the limb 5-6 cleft, irregular, rarely equal, imbricate in æstivation, and late in falling off. The stamens are two, the filaments united with the style, forming an elongated column; the anthers 1 or 2-celled, when the latter didymous and incumbent on the stigma, and dehiscent by chinks. The pollen simple and globose, sometimes angular. The germen, often crowned with one or two glands, is formed of 2 connate carpels, 2-celled, or sometimes 1-celled, by the abbreviation of the dissepiment, which is parallel and placentiferous. The style is connate with the filaments, and the stigma, which is simple or bifid, is enclosed and hidden by the anthers.

The fruit is capsular, 2-celled, or subunilocular; 2-valved, with the dissepiment parallel to the valves, sometimes contracted, and subsequently loosened from the introflexed margins of the valves. The seeds are indefinite, small, and erect, sometimes pedicellate and attached to the axis of the dissepiment. The albumen, of the same shape as the seed, is fleshy and somewhat oily, and includes the embryo, which is minute.

(4293.) Hence, differentially considered, the *Stylidiaceæ* are gynandrous *Campanulinæ*, or synpetalous exogenæ, with an irregular corolla, and stamens connate with the style.

(4294.) The structure of these plants is highly curious, and has led some eminent botanists into extraordinary errors. The pistil is so concealed by the stamens, that by Labillardiere and L. C. Richard it was wholly overlooked, the former believing the epigynous gland to be the stigma, and the latter thinking that the lower lip was a petaloid pistil. The irritability of the column in *Stylidium* is a phenomenon of much physiological interest: but here the interest of these plants ends, for, like the preceding type, of their properties and uses there is nothing at present known.

(4295.) Campanulaceæ. The Bell-flowers and their allies are herbaceous or shrubby plants, in general lactescent, with round or irregularly angled stems, alternate, rarely opposite leaves, simple, often lobed, sessile or petiolate, and destitute of stipules.

The inflorescence is terminal or axillary, solitary or aggregate, and variable in its form, being either paniculate, racemose, spicate, or even capitate; and the pedicels either naked or bibracteate. The flowers are united, in one subtype regular, but in the other irregular.

The tube of the calyx is adnate with the ovary, the limb 5 (rarely 4-8), cleft, equal, and persistent. The corolla is synpetalous, deciduous, or marcescent, regular or irregular, 5 (rarely 4-6-8) cleft, or formed of 5 petals, with broad conniving ungues. The calyx is lined by an annular disk or torus, which bears both the corolla and the stamens. The æstivation is valvate. The stamens are definite, equal in number to the petals, and alternate with them. The filaments are free, the anthers erect, 1-celled, discrete in one subtype, but syngenesious in the other, and dehiscent lengthwise by chinks. The pollen round in the *Campanulidæ*, and oval in the *Lobelidæ*. The germen is inferior or half inferior, formed of 2 or more connate carpels, 2- or many celled, and many-ovuled. The style is single and the stigma undivided, or with as many divisions as there are cells in the germen; and sometimes surrounded by a cup-like fringe, simulating an indusium.

The fruit is capsular, 2 (1-3) celled, inferior or half inferior, and opening by lateral pores below the limb of the calyx, or sometimes at the summit by valves, bearing the placentæ. The seeds are indefinite, small, and erect; the albumen fleshy, the embryo straight, in the axis of the albumen, and the radicle inferior.

(4296.) Hence, selecting the chief differential characters, the *Campanulaceæ* are lactescent *Campanulinæ*, with a valvate æstivation of the corolla, stamens not coherent with the style, which is pilose, but not indusiate. The fruit capsular, and the seeds indefinite and albuminous.

(4297.) The structural differences that occur amongst the *Campanulaceæ* have led to their separation into two subtypes, by some persons considered independent orders, and which, from *Lobelia* and *Campanula*, the normal genera, are called

the *Lobelidæ* and *Campanulidæ*, the one being synantherous or syngenesious, and the other corisantherous *Campanulaceæ*.

(4298.) In the *Lobelidæ*, or syngenesious *Campanulaceæ*, the corolla is irregular, sometimes 5-petaled, the anthers coherent, and the pollen oval;

(4299.) While in the *Campanulidæ*, or corisantherous *Campanulaceæ*, the flowers are regular, the stamens discrete, and the pollen round.

(4300.) The lactescence of these plants, as well as many points in their structure, such especially as the syngenesious stamens of the *Lobelidæ*, and the hairy styles of both subtypes shew their affinity to the compositæ, and in particular to the *Cichoraceous* group. The milky juices of the *Campanulidæ* are acrid, but those of the *Lobelidæ* much more so; hence the former are considered innocuous, but the latter deleterious, or at least suspicious plants.

(4301.) CAMPANULIDÆ. The roots of several species of *Campanula* are eatable. *C. Rapunculus* is the common Ramp or Rampion, which is much cultivated as an esculent vegetable in France and Italy. *C. Rapunculoides* and *persicifolia*, are also sometimes grown as dietetic plants, but the Campanulas are more valued for their beauty than their economical value. *C. pyramidalis* is a very handsome plant, and keeps in flower for several months. *C. Trachelium*, *C. Speculum*, *C. glomerata*, &c. are also very ornamental. *C. lilifolia* is interesting,

Campanula Trachelium.

A. Leaves and inflorescence.

(*a*) Calyx and pistil.

(*b*) The fruit.

(*c*) Transverse section of the same, to shew the 3-cells axial placenta, and many seeds.

(*d*) A seed magnified.

(*e*) Section of ditto, to shew the embryo and albumen.

from the circumstance of its leaves being before blossoming crowded on the summit of the stem by the arrest of the axial evolution, so as to form a bunch resembling a rose; but, during the after-development of the panicle, the axis becomes elongated, and the leaves, at one time crowded, are scattered over the lengthened stem. The roots of this species are eaten in China, both in a raw state, and when boiled.

(4302.) The young shoots of *Canarina campanulata* are said by De Candolle to be eaten in the Canary Islands; and those of *Phyteuma spicata* are also esculent. *M. Larbalestrier,* in a communication to the Royal Society of Medicine, of Paris, has spoken highly of the curative powers of a species of Phyteuma growing on the Alps, which he affirms to be a remedy in cancers and various cachectic sores. He does not specifically name or describe this *Phyteuma,* and it is to be feared that it will not prove more powerful than the *Phyteuma* of Dioscorides, which used to be relied on as a physical means of exciting love.

(4303.) *Lobelidæ.* The milky juices of these plants, although often acrid, and sometimes poisonous, vary in the degree of their acridity, and are even occasionally mild and insipid, as is the case in *L. tenella.* Their milk, especially that of the species growing in warm climates, contains caoutchouc; and from one, hence called *L. caoutchouc,* this very useful substance is procured. *L. inflata* has been much commended for the relief it affords in difficulty of breathing, and it appears to have been administered in asthmas, and even in croup, with much advantage; it is both emetic and diaphoretic, but it should be exhibited with caution, for several cases are on record in which death has been caused by too large doses: *L. longiflora* is also poisonous; and, from its destroying horses that feed upon it, it has

C

Lobelia syphilitica.

c. Cutting, to shew alternate leaves and inflorescence.

(*a*) A flower separated.

(*b*) The same deprived of the calyx and corolla, to shew the syngenesious anthers surrounding the style.

(*c*) The pistil.

(*d*) The fruit, with the persistent calyx.

(*e*) Section of ditto.

(*f*) A seed magnified.

(*g*) Section of ditto, to shew the embryo included in the albumen.

(*h*) The embryo isolated.

been called in St. Domingo *Chatta cavallo;* and in Spain, where it is cultivated, *Rabienta cavallos.* The negroes resort to it occasionally as a poison; and Jacquin says the juice, if accidentally applied to the eyes, brings on violent inflammation. *L. urens* is likewise a very noxious plant, but *L. Tupa* appears to be the most acrid and deleterious of the whole. Feuillée says, that even the odor of the flowers will cause excessive vomiting; and, if applied to the skin, or taken internally, its acridity produces violent inflammation and pain, often followed by death.

L. syphilitica has been much extolled for its influence in certain cachectic disorders, and *L. cardinalis* has been used as an anthelmintic, but neither of them are now held in much esteem. Thunberg mentions a species of *Lobelia*, a native of the Cape of Good Hope, the roots of which are eaten by the Hottentots, who call the plant *Karup*.

ERICINÆ.

(4304.) The heaths (*Ericæ*), with the bilberries (*Vaccinia*), the Australian heaths (*Epacrides*), and their respective allies, once all included in a single order, but now divided into many, are here associated, and distinguished by being considered the several types and subtypes of a common section; which, from the normal genus, *Erica*, may be called the *Ericinæ*.

(4305.) Collectively considered, the *Ericinæ* are pericorollous *Syringales* or *Ericosæ*, with in general regular flowers; calyx free (rarely adnate), the lobes of the corolla mostly imbricate in æstivation, stamina equal in number to the petals, and alternate with them, or twice as many. The anthers usually 2-celled, and distinct at base or apex; the germen 5-4 (rarely 1-celled), the cells agreeing in number with the lobes of the calyx and corolla, and the placentæ central and many-seeded.

(4306.) The three types or chief divisions of the section admitted here, are the *Vacciniaceæ*, *Ericaceæ*, and *Epacridaceæ*, so called from the normal genera, already mentioned. The other subdivisions alluded to, such as the *Pyrolaceæ*, *Monotropeæ*, *Rhodoraceæ*, &c. are merely subordinate groups, more correctly esteemed subtypes or districts.

(4307.) VACCINIACEÆ. The bilberry and its immediate allies are shrubby plants, with aqueous juices, round or irregularly angled stems and branches; al-

C

c. *Vaccinium Myrtillus*. Branch with fruit.

(*a*) A flower deprived of calyx and corolla, to shew the stamens.

(*b*) The corolla.

(*c*, *d*) Side and front views of a stamen, shewing its hornlike processes.

(*e*, *f*) Section of the fruit.

(*g*) A seed, (*h*) section of ditto.

(*i*) The embryo.

ternate, simple, entire leaves, often coriaceous and perennial, and sometimes with glandular dots on the under surface; the petioles short, and the stipules wanting.

The inflorescence is solitary or racemose, and the flowers regular and united.

The tube of the calyx is adnate to the germen; the limb epigynous, 4-5-6 toothed or entire, and sometimes deciduous. The corolla epigynous, synpetalous, 4-5-6 toothed, or sometimes cleft; the divisions being equal in number to the lobes of the calyx, alternate with them, and imbricate in æstivation. The stamina are twice as many as the petals, uniseriate, and exserted from an epigynous disk; the filaments are free, the anthers terminal, 2-celled, and the cells parallel, discrete at the summits, prolonged into horns, and dehiscent at the apex by pores. The germen is inferior, but naked at its summit, and surmounted by an epigynous disk or torus, which bears both the corolla and stamens. The cells are 4-5, alternate with the segments of the calyx; the trophosperms are central and many-ovuled, the style single, and the stigma for the most part capitate. The fruit is baccate, subglobose, umbilicate at the apex, and crowned with the persistent limb of the calyx; fleshy or juicy, indehiscent, 4-5 celled, and the cells few or many-seeded. The seeds are small, ascending (furnished with both arillus and chalaza?) The albumen is fleshy and transparent; the embryo straight, white, and axile, the radicle long and inferior, and the cotyledons narrow, and very short.

(4308.) Hence, selecting the chief differential characters, the *Vacciniaceæ* are deviating *Ericinæ*, with epigynous corolla and stamens; the germen being inferior, the corolla regular, the anthers 2-celled and 2-horned, the fruit succulent, and the seeds many.

(4309.) From the above detail and summary of structure, it is evident that the *Vacciniaceæ*, by the strict rule of system, belong rather to the epicorollous than to the pericorollous class of Jussieu to the calyciflorous, than to the corolliflorous subclass of De Candolle; and to our *Asterosæ* than *Ericosæ*. But, excepting in the epigynous exsertion of their corolla and stamens, they are so similar in general structure to the heaths, that at one time they were combined with the *Ericaceæ;* and still, by some high authorities, as by Richard, that connexion is preserved. Hence, notwithstanding their deviation from the general diagnostic sign, their location is undisturbed; for, as the natural system is one of synthesis, not of analysis, these aberrations are of little moment; they only furnish additional evidence, and repeat the oft-told warning, that when natural affinities are scrupulously attended to, arbitrary differential signs must be frequently neglected.

(4310.) The *Vacciniaceæ* are slightly astringent plants; their bark and leaves have been used as tonics, and they are said to be possessed of diuretic properties. These latter are probably most developed in *Vaccinium resinosum,* and *glaucum;* the under sides of the leaves of which are thickly set with glands, that furnish abundance of resin.

The fruits of most, being fleshy and juicy, are eatable, and those which are not too acrid or astringent, form pleasant food. *V. Myrtillus* is the common bilberry; *V. uliginosum,* the bleaberry; *V. Vitis Idæa,* the cowberry; *V. Oxycoccus,* now called *Oxycoccus palustris,* the common cranberry; *O. macrocarpus,* the great-fruited cranberry; and various other species of *Vaccinium* are known as *Whortleberries.* The fruits of these plants, when fermented, afford an intoxicating liquor; they are used occasionally to restore the faded colours of certain wines, and attempts have been made to dye paper and linen of a violet colour with their

juice. Moor-game live on the berries of these plants, which abound in the north of Europe. Goats feed upon their leaves and branches, but cows and horses refuse them as fodder. Large quantities of cranberries are collected in Russia and Poland for exportation, and in various counties of England and Scotland they are eaten in tarts and with cream. The Highlanders often mix them in the whisky they give to strangers, in order to disguise its strength and flavor, the latter of which is anything but pleasant to untutored palates. The fruit of *V. uliginosum* is said to possess narcotic powers, and it is sometimes put into beer and other liquors to make them heady. The cowberries make an excellent jelly, which is far superior to that of the red currant for eating with venison. In China *V. formosum* is esteemed a sacred plant, and its flowers are gathered at the opening of the new year, and placed as offerings by the devout in all their temples.

(4311.) The *Escalloniæ*, sometimes confounded with the *Vacciniaceæ*, are essentially different in their structure, and belong to another order, (§ 3227); their flowers are polypetalous, and their anthers dehisce by longitudinal chinks.

(4312.) Ericaceæ. *Erica* (the heath), and *Pyrola* (the winter green), are the normal genera of the two subtypes, *Ericidæ* and *Pyrolidæ* or *Monotropidæ*. These are sometimes elevated to the rank of distinct orders, but they are here associated as subordinate divisions of a common type, which from the first named genus may be called the *Ericaceæ*.

(4313.) The *Ericaceæ*, collectively considered, are suffruticose, shrubby, or arborescent plants, with roundish stems and branches, and aqueous or slightly resinous juices. The leaves are alternate, opposite or whorled, often coriaceous and acerose; simple, frequently entire, occasionally dentate or serrate, and articulated with the branches; often evergreen (rarely wanting), stipules always absent.

The inflorescence is terminal or axillary, solitary or aggregate; when the latter, variable, being either racemose, corymbiform, sub-umbellate, fasciculate, or subcapitate; the flowers pedicelled, sometimes surrounded by imbricate, scarious, or coloured bracteæ, regular and united.

The calyx is free, synsepalous, 4-5-parted (rarely 2-6-8 cleft), nearly equal, persistent, and with the segments alternately imbricate in æstivation. The torus forms a ring-like disk, lining the base of the calyx or surrounding the germen. The corolla is synpetalous, 4-5 cleft, sometimes separable in 4-5 pieces, regular or irregular, with the petals equal in number to the sepals, alternate with them, and exserted from the edge of the disk; hence perigynous, or occasionally almost hypogynous, imbricate in æstivation, and often marcescent. The stamens are definite, equal in number to the petals, and alternate with them, or twice as many, and exserted either from the petals or the edge of the torus. The filaments are free, the anthers terminal, incumbent, often becoming inverted, 2-celled, with apposite, contiguous, and more or less discrete locules furnished with appendages, and dehiscent by pores or chinks. The germen is free, formed of several connate carpels, equal in number to the lobes of the calyx and alternate with them, arranged in a whorl round the axis, to which the trophosperms, which are many-ovuled, are adnate. The style is single and cylindrical, exserted from the column, the stigma in general capitate, but sometimes toothed or lobed.

The fruit is capsular or baccate, many-celled and many-seeded, and with a variable dehiscence; sometimes being loculicidal, and sometimes septicidal. The placentæ

2

are central, often tumid, the seeds for the most part indefinite, (rarely few or solitary), small, with the coats loose in one subtype, but in the other firmly adherent to the nucleus, the albumen fleshy, the embryo straight and axile, and the radicle turned towards the hilum.

(4314.) Hence, differentially considered, the *Ericaceæ* are normal *Ericinæ*, with a free germen, 2-celled, dry, appendiculate anthers, and an embryo in the axis of a fleshy albumen.

(4315.) The two subtypes *Ericidæ* and *Pyrolidæ* are instituted for the purpose of segregating certain genera, which differ in some important points of structure, such as a shrubby or herbaceous port, regular or irregular flowers, straight or declinate style, winged or wingless seeds, &c.; but that these differences do not afford more than subtypical diagnostic signs, is evident from one of the *Pyrolæ* belonging to the herbaceous group being frutescent; by the style in the *Pyrolidæ* being sometimes not declinate but straight, as in the *Ericidæ;* and by one of the *Ericæ*, although belonging to the apterous group, having broad, winged seeds; still the distinction is convenient, and the following are the most general differences.

(4316.) The *Pyrolidæ* are herbaceous *Ericaceæ*, having anthers with or without appendages, the style mostly declinate, the seeds very minute and furnished with wings, and the testa large, loose, and reticulated, and the embryo inverted;

(4317.) While the *Ericidæ* are shrubby or arborescent *Ericaceæ*, with regular or irregular corollæ, appendiculate anthers, a straight style, small seeds, and the testa closely adherent to the nucleus.

(4318.) Pyrolidæ. Pyrola, and its allies, are innocuous plants, most of them

B

B. *Pyrola rotundifolia*. Entire plant.

(*a*) Flower separated.

(*b*) One of the stamens isolated.

(*c*) Fruit.

(*d*) Section of the same.

(*e*) Seed magnified.

(*f*) Ditto, with a part of the arillus removed.

(*g*) Seed, with the arillus wholly removed and cut through, to shew the embryo.

are slightly astringent, such as *P. rotundifolia*, and one, *Chimaphila* (olim *Pyrola*) *umbellata*, is esteemed as a powerful diuretic; it is likewise reputed to be further valuable from its decidedly tonic properties. Its leaves are said to be slightly

irritating, and to inflame or vesicate the skin when applied to it. *Pyrola aphylla*, which is destitute of leaves, thus associates the leafless *Monotropæ* and *Pterospora* with the leafy *Ericidæ*, as well as indicating, through these curious parasitic plants, an affinity to the leafless parasitic orobanches.

(4319.) ERICIDÆ. The variations of dehiscence of the fruit in this subtype led Jussieu and De Candolle to divide it into two orders, the *Rhododendra* and *Ericæ* of the one, or the *Rhodoreæ* and *Ericeæ* of the other; and, although the differences do not seem to be of sufficient importance, or sufficiently constant to justify the establishment of two distinct orders, still, as the plants contained in each vary considerably in properties, it may be as well to retain them as subtypical districts, always however bearing in mind that there are frequent exceptions as to characters on both sides: the difference of properties being far more constant than that of structure.

(4320.) *Kalmia*, *Rhododendron*, *Azalea*, and *Epigæa*, which form the Jussieuan mono- or synpetalous *Rhododendreæ* and *Rhodora*, *Ledum*, *Befaria*, and *Itea*, which form his sub-polypetalous *Rhodoreæ*, constitute together the first of these subtypical districts, which was supposed to be distinguishable from the *Ericeæ* by the stigma being for the most part capitate, the fruit capsular, and the dehiscence septifragal or septicidal, the margins of the valves being introflexed and connected with the axis;

(4321.) While *Erica*, and the rest of the *Ericidæ*, forming Jussieu and De Candolle's *Ericeæ*, were defined as having the fruit baccate or capsular, the dehiscence loculicidal, the valves bearing the placentæ along their centres and connected to the axis only at the bottom. The stigma being likewise for the most part simple.

(4322.) The *Rhodoreæ* are all suspicious, and some deleterious plants. The decoction of the leaves of *Kalmia latifolia* is said by Barton to be poisonous both to men and beasts, although brute animals are known to feed on the plant in a raw state without any immediate perceptible injury. But Bigelow assures us that the flesh of young pheasants, after feeding on the *Kalmia* buds and shoots, becomes poisonous to man; and some cases of severe disease are on record which seem to be attributable to this cause alone. The flowers of the *Kalmiæ* exude a large quantity of sweet nectareous juice, which is greedily collected by bees and wasps, but the honey formed from it is found to be deleterious to man, and even the nectar itself is said, when swallowed, to bring on intoxication of a phrenitic kind, which is not only formidable in its symptoms, but also very lengthened in its duration. The stems and branches of these plants, as well as of the *Rhododendra* and *Andromedæ*, are covered with a brownish powder, which is used in the United States of America as a sternutatory; but prolonged indulgence in the use of this snuff is said not to be without inconvenience. The *Kalmiæ* are remarkable for the irritability and curious construction of their stamens, each having a hollow retreat formed in the corolla for the protection of the anther.

(4323.) *Azalea Pontica* and *Rhododendron Ponticum* exude, like the *Kalmiæ*, a nectareous juice, from which honey is collected, having similar intoxicating and poisonous properties to that of the American plants. This *Azalea* is believed to be the *Ægolethron* of the ancients; and it was to many of the soldiers eating honey collected from such plants, that the plague was attributed which afflicted the army of Xenophon, in the celebrated retreat of the 10,000. *Rhododendron Ponticum* affords a similar deleterious nectar; and, as it grows with the

Azalea Pontica, they were both probably implicated in producing the calamity just mentioned. *R. maximum* and *chrysanthum* are likewise suspicious plants, although goats and sheep are said to feed upon them with impunity; and Pallas tells us, that in Siberia, where the latter grows, its leaves are gathered, and an infusion of them drank as a refreshing beverage, in the same manner as we drink the China leaf; and that the name of the plant is *schei*, or tea. The infusion of a decoction of this *schei* is narcotic, and, when taken in any quantity, inebriates. Steller says, this having been accidentally discovered by one of his companions (Capriolus), his servants were continually taking small quantities as an exhilarant. It has been employed in medicine, and highly extolled for its influence over gout and rheumatism, especially in constitutions where *colchicum* disagrees. The Russians also use it in baths or fomentations, to relieve pains of the limbs, and lessen the feeling of fatigue.

(4324.) *Ledum latifolium* has been much commended as a stomachic. It is fragrant, and has a pleasant aromatic bitter flavour. It is said to excite appetite; and, during the war for independence, its leaves were used in the United States as a substitute for tea. *L. palustre* has somewhat similar properties, and has been used for similar purposes. In Germany a sort of beer has been brewed from its leaves; and it has also been recommended as a febrifuge.

(4325.) *Arbutus* (the strawberry-tree), *Arctostaphylos* (the bearberry), with *Andromeda*, *Calluna*, *Menziesia*, and the vast unwieldy genus *Erica*, are sufficient illustrations of the Jussieuan group *Ericeæ*, which is nominally retained merely on account of the difference in properties observable between its included genera, and those referred to his group *Rhododendra*, or *Rhodoreæ*. For, instead of the active and often poisonous principles developed in them, these *Ericeæ* are altogether devoid of active qualities: they are inodorous, nearly tasteless, innocuous, and of such an arid nature as to lose little or nothing by exsiccation. The chief and most constant principle found in the *Ericeæ* is tannin. The *Ericæ*, and most of their allies, are remarkable for their almost utter destitution of essential oils, resins, and gum-resins; and hence their want of smell. Their flowers, though often extremely beautiful, being scentless, the fruits also are for the most part dry, membranous, or woody capsules, unfit for food; but those which are baccate are in general esculent and palatable; such as *Gaultheria procumbens* and *G. Shallon*, *Arctostaphylos alpina*, and several species of *Arbutus*.

(4326.) The *Gaultheriæ*, besides affording eatable fruits, are remarkable, in this generally scentless group, for their fragrance. The leaves of *G. procumbens*, the *Palommier*, or Canada tea, have a very pleasant odor; and in infusion, Bigelow says, they are used as a substitute for tea, and also taken as a stimulant, as well as administered medicinally as a diuretic. Coxe states that this infusion is serviceable in asthma. *G. fragrantissima* is likewise a sweet-smelling plant.

(4327.) *Arctostaphylos Uva ursi* is the bearberry, the leaves of which are bitter, astringent, and demulcent. In powder and decoction, they have been found of much use in the cure of irritable bladder, and in disorders of the kidnies and their subservient organs. They have also been sometimes employed in the process of tanning.

(4328.) *Arbutus Andrachne*, *integrifolia*, *mucronata*, *petiolaris*, and *Unedo*, all bear edible fruits, but they are not in general much esteemed. Wine, vinegar,

and spirit, are procured from the berries of the latter, which are said to be wholesome, and really pleasant when fully ripe; for, although naturalized, if not a native of England, and abundant in Ireland, it wants a Numidian sun to develop the flavor of the fruit, and render it digestible. This plant is one of the arboreous *Ericeæ;* and its wood, which is hard and prettily veined, is in request by turners for ornamental works. In the neighbourhood of Killarney, where the hills which bound the lakes are covered with strawberry-trees, boxes, chess-men, &c. are made from the wood, and generally purchased by visitors as memorials of the place. *A. petiolaris* is said by Humboldt to be infested with a moth that affords silk, which is used in the manufactures of Mexico.

(4329.) *Andromeda* has been given as a generic name to a series of elegant and somewhat pretty plants, inhabitants of Alpine swamps and sea-marshes, being chained as it were to bleak rocks and desert places, and surrounded by monsters of the deep, like their virgin namesake, with whose history Linneus, who lost no opportunity of indulging his romantic imagination, feigns an ingenious and interesting parallel.

(4330.) *Andromeda polifolia,* which is a native of Britain and the northern parts of Europe, has been used instead of nut-galls. Its decoction, according to Gmelin, is inebriating, and in Siberia it is resorted to as the source of an exhilarating beverage.

The leaves of *A. arborea* form, when boiled, a mildly acid drink, which in the United States is administered to relieve the thirst and moderate the heat attending ardent fevers. Barton says that *A. Mariana* is poisonous; its decoction is, however, found serviceable as a wash in those cases of ulcerated feet so common among the slaves in the southern States of the Union. The powder of its seeds, as well as the brown dust-like matter that covers the twigs in this and other allied plants, is used, like that of the *Azaliæ* and *Rhododendra,* as a sternutatory. *A. ovalifolia* is affirmed to be also poisonous; and we are told that in Nipal goats are killed by feeding on its shoots. A Javanese species is also said by Dr. Horsfield to be very irritating: it contains a volatile oil, of a peculiar odor, which is serviceable in rheumatism.

(4331.) *Erica* is a most extensive genus, comprehending between 5 and 600 known species, and hence it imperatively requires to be broken up, if not into distinct genera, at least into several subgeneric groups; for the segregation of Calluna and Menziesia have done little towards reducing their amount. Until within the last fifty or sixty years not more than five or six species of heath were known, viz. 1, Calluna; 2, Menziesiæ; and 3 or 4 species of Erica, natives of Britain; and 1, Erica Mediterranea, common in Spain, and said to have been lately discovered in Ireland; the former being dwarfish shrubs, and the latter an arborescent plant. But, after the British obtained possession of the Cape of Good Hope, new, beautiful, and extraordinary heaths were discovered in profusion. They are in general elegant, and often very pretty plants, deservedly favorites in every collection, and their successful culture is one of the tests of an accomplished gardener. The properties of the heaths are insignificant; some few, as the *Erica odor-rosea* and *E. tenuiflora,* are delightfully fragrant, the former smelling like attar of roses, and the latter resembling a carnation; but the vast majority are wholly scentless. It is said that the Picts made a delicious and wholesome liquor

with the *Erica cinerea:* but if they did, the method perished with them, as it is now unknown. Boethius accounts for this from the legend, that the mode of preparing

A

A. *Erica longiflora.* Cutting, to shew leaves and flowers.

(*a*) Corolla laid open.

(*b*) Stamens and pistil, the perianth being removed.

(*c*) The fruit of *E. cinerea.*

(*d*) Section of the same.

(*e*) A seed magnified.

(*f*) Section of the same, to shew the albumen and embryo.

(*g*) Seeds of their natural size.

such a delightful beverage was never communicated by them to any but their own blood, and hence the art was lost with their extermination:

> "Though unobtrusive all thy beauties shine,
> Yet boast thou rival of the purple vine!
> For once thy mantling juice was seen to laugh
> In pearly cups which monarchs loved to quaff;
> And frequent wake the wild inspired lay,
> On Teviot's hills, beneath the Pictish sway." *Leyden.*

(4332.) This heath, as well as the Calluna, (the ling or heather), grows in barren Alpine moors, where no other vegetable substance abounds, and is applied to a variety of useful purposes. There the highlanders make the walls of their cabins of mud or cement, strengthened with heather; heather also thatches these huts, and ropes of heather form a sort of lattice-work or window; highland beds are often made of heather, highland cloths dyed yellow with its shoots, and highland flocks occasionally fed upon its young tops. And several Highland lairds, it is reported, derive no small proportion of their revenues from the heather, which is made into besoms, and sold throughout the kingdom. Few animals, however, relish it as food; but it supports myriads of birds, and affords them cover. It is also a favorite resort of insects, especially of bees, but heath-honey is of a dark colour, and unsightly, although not inferior in flavor to that collected from other plants.

(4333.) Epacridaceæ. *Epacris,* and its typical associates, are shrubs or small trees, with nodeless branches, sometimes covered with down, which, when present, is simple. The leaves are alternate, rarely opposite, entire, attenuated

towards the petiole, or sessile, or even cucullate and semi-amplexicaul, and destitute of stipules.

The inflorescence is axillary or terminal; when the former, solitary, when the latter, spicate or racemose. The flowers are united, or by abortion separate, regular, white or red, seldom blue, and often involucrate by two or more coloured bracteæ, which are imbricate.

The calyx is free, synsepalous, 5-parted, persistent, and often coloured. The corolla synpetalous and quinquifid, rarely quadrifid, the conjoined petals sometimes separable, deciduous or marcescent, valvate or imbricate in æstivation, occasionally coherent by their apices, forming a calyptra, which is circumscissile at the base; the exsertion being hypogynous, the stamina hypogynous or epipetalous, equal in number to the petals, and alternate with them in their exsertion, seldom fewer. The filaments are free, the anthers incumbent, exappendiculate, sometimes bordered, simple, with a single cell or receptacle for the pollen, and dehiscent longitudinally. The pollen is subglobose or slightly angled, free, or the grains connate by threes. The germen is free, sessile, formed of 2-10 connate carpels arranged in a whorl round the axis, 2-10-celled, rarely unilocular by abortion (as in Monotoca). The placentæ adhere to the central column, and are 1- or many-ovuled, the style 1, and the stigma undivided or occasionally dentate.

The fruit is capsular, baccate, or drupaceous, the placentæ adherent to the axis, sometimes separating at the base, and pendulous, seeds albuminous, indefinite or definite, seldom by abortion solitary, and the embryo straight and round, and more than half the length of the albumen in the axis of which it is included.

(4334.) Hence, differentially considered, the *Epacridaceæ* are subperigynous or hypogynous *Ericinæ*, with regular flowers, furnished with imbricate bracteæ, dry, 1-celled exappendiculate anthers, and usually a many-celled many-seeded fruit.

(4335.) Brown, who first distinguished and characterized the *Epacridaceæ*, separated the included genera into two subtypes, called, from *Styphelia* and *Epacris*, the *Styphelidæ* and *Epacridæ*, or genuine *Epacrideæ*.

(4336.) In the former, or *Styphelidæ*, the corolla is in general valvate in æstivation, the cells of the ovary 1-seeded, the pericarp indehiscent, baccate, or drupaceous, rarely capsular;

(4337.) While in the latter, the *Epacridæ*, the æstivation of the corolla is imbricate, the cells of the germen many-ovuled, and the fruit capsular.

(4338.) The *Epacridaceæ* supply the place of the *Ericaceæ* in New Holland and the Polynesian Isles. They are very similar in habit and structure to the *Ericæ*, and have been called Australian heaths; they also resemble the *Ericæ*, in the beauty of their flowers and their general destitution of active properties; so that none have been used in medicine, and very few are applicable to ordinary domestic purposes. *Lissanthe sapida*, however, one of the *Styphelidæ*, is the Australian cranberry, and it is one of the few indigenous eatable fruits of New Holland. *Epacris pulchella* is sweet-scented.

STYRACINÆ.

(4339.) The third and last section into which the *Ericosæ* or peri-corollous Syringales has been divided, includes three or four types or natural families, which, from *Styrax*, *Belvisia*, *Achras Sapota*, and *Diospyrus Ebenum*, have been

called the *Styraceæ, Belvisiaceæ, Sapotaceæ,* and *Ebenaceæ;* the former giving likewise to the whole a common collective name.

A. *Diospyrus Lotus.* Twig with fruit. (*a*) Stamineous flower. (*b*) Pistilline flower. (*c*) Calyx and pistil. (*d*) Transverse section of the fruit. (*e*) A seed. (*f*) Section of ditto, shewing the embryo within the albumen. (*g*) The embryo isolated.

B. *Achras Sapota.* Branch, with leaves and flowers. (*a*) A single flower. (*b*) The corolla opened, to shew the stamens. (*c*) The pistil. (*d*) The fruit. (*e*) Transverse section of ditto. (*f*) A seed. (*g*) Transverse section of ditto. (*h*) The embryo.

C. *Styrax officinale.* Branch, with leaves and flowers. (*a*) Flower laid open, to shew stamens and pistil. (*b*) Pistil. (*c*) Transverse section of the germen. (*d*) The fruit. (*e*) A section of ditto. (*f*) A seed. (*g*) A section of ditto.

(4340.) The *Styracinæ* are evidently a transitional group, belonging, as Hooker observes, as much to the Calycifloræ as to the Corollifloræ of De Candolle, and, like the Epacridaceæ, as much to the hypogynous as to the perigynous classes of Jussieu. Indeed, it is observable, that throughout the *Ericosæ* the exceptions to the arbitrary character of exsertion of the corolla are very frequent, the *Vacciniaceæ* having it epigynous, the *Ericaceæ* and *Epacridaceæ* scarcely perigynous, and in the *Styracinæ* it is chiefly hypogynous; so that, were the artificial signs either of Jussieu or De Candolle to be strictly observed, so as to render either scheme useful as an index, the natural affinities of many groups would be grossly violated.

(4341.) The *Styracinæ,* collectively considered, are deviating *Ericosæ,* with arboreous or shrubby stems, alternate, simple, exstipulate leaves, regular flowers, the calyx free or slightly adherent to the germen, the corolla peri- or hypo-

gynous, and in general staminiferous, some of the filaments often sterile, ovary many-, rarely 1-celled, fruit indehiscent, seeds definite or solitary, placentæ central, indistinct, and the radicle turned towards the hilum.

(4342.) STYRACEÆ. *Styrax*, and its typical allies, are trees or shrubs, with aqueous juices, round or irregularly angled stems and branches, alternate, simple, entire leaves, with short petioles, and exstipulate. The pubescence often stellate.

The inflorescence is axillary, seldom terminal, crowded or racemose, and the flowers regular, and united. The calyx is synpetalous, more or less adherent to the germen, hence superior or inferior, 4-5 cleft, seldom entire, and persistent. Disk none. The corolla is sometimes hypogynous, and sometimes exserted from the faux of the calyx, synpetalous, the limb 4-5 cleft, with the segments alternate with the lobes of the calyx, often 8-10 cleft, with the intermediate laciniæ the smallest. The æstivation in general is valvate, but not unfrequently imbricate. The stamina are exserted from the tube of the corolla in 2-4 series, definite or indefinite, and unequal in length. The filaments in general slightly coherent at their bases. The anthers 2-celled, innate, introrse, and dehiscent lengthwise by chinks. The germen is half-inferior or superior, formed of 3-4-5 connate carpels, 3-5-celled, the ovules definite, (usually 4 in each cell, seldom solitary), 2 being erect and 2 pendulous, and the placentæ central, but indistinct. The style 1, cylindrical, straight, and the stigma 3-5-lobed.

The fruit is drupaceous, girded, or crowned by the persistent calyx, with a hard putamen, 3-5 celled, or 1-celled by abortion, the dissepiments thin and membranaceous, the seeds in general solitary, ascending, or pendulous, according as to which ovules are abortive. The testa and tegmen distinct, the outer sometimes relaxed, the albumen small and fleshy, including the embryo, which is axile, straight, or nearly so, almost as long as the albumen, the radicle elongated and turned towards the hilum, and the cotyledons very short, flat, and foliaceous.

(4343.) Hence, differentially considered, the *Styraceæ* are drupaceous *Styracinæ*, with mostly perigynous corollæ, innate, introrse anthers, inferior or half-inferior germen, ovules ascending and descending in pairs, and mostly solitary albuminous seeds.

(4344.) This group has been divided into two or three subordinate series or subtypes, of which *Styrax*, *Symplocus*, and *Halesia*, are the typical genera; but, as this subdivision cannot be considered established, and as the whole of the genera included are very few, not perhaps exceeding six or seven, it is not admitted here.

(4345.) The *Styraceæ* are slightly astringent, and more or less fragrant plants, their aroma depending on a peculiar acid, the *Benzoic*, combined with a resin or balsam, which is found in the greatest abundance in two species of *Styrax*, viz. *S. officinale* and *S. Benzoin*. These resins or concrete balsams were once much esteemed in medicine as stimulants and expectorants, but they are now seldom used in this country excepting as external applications, in the manufacture of court plaister, and fumigating pastilles. In countries, however, where the Roman Catholic and Mahomedan religions prevail, large quantities are consumed as incense. The annual export from London to Mogadore alone is estimated at upwards of 30,000 lbs.

(4346.) *S. officinale* is a native of the southern parts of Europe, the shores of the Red Sea, and Asia Minor. Two sorts of balsam are brought to us from

the Levant: 1, the red or lump *Storax*, which is full of all kinds of impurities; and, 2, the *Styrax calamita*, or storax in tears; so called from the tear-like drops in which it exudes from the tree, having in ancient times been collected and transported from place to place in hollow reeds. These balsams must not be confounded with the *Liquidamber*, also called *Storax* in commerce, and which is procured from a very different plant, viz. the *Liquidamber Styraciflua.*

(4347.) *S. Benzoin,* which affords the Benjamin of commerce, is a native of Sumatra and Borneo. Three sorts or qualities are distinguished by merchants, under the technical names of "head," "belly," and "foot;" the comparative values of which may, according to Crawfurd, be expressed by the figures 105, 45, 18. Besides its chief use as incense, *Benzoin* is frequently employed to fumigate sick rooms, and in Japan to perfume houses; and the Japanese chiefs are said to smoke it, as a luxury, mingled in tobacco.

(4348.) *Benzoic acid,* which is principally obtained from this balsam, exists likewise in *Styrax*, the balsam of Tolu and Peru, the *Melilot,* the sweet vernal grass, and other plants. It is a slight stimulant, and retains a place in our national pharmacopœias. The compound tincture of Benzoin is the only officinal preparation into which the balsam now enters; but it is the principal ingredient in many empirical medicines, known under the imposing names of *Virgin's Milk, Friar's Balsam, Jesuit's Drops, Riga Balsam, Pectoral Balsam of Honey, Essence of Coltsfoot,* &c. &c.

(4349.) *Symplocus* vel *Hopea tinctoria,* and some other species of the same genus, afford good yellow dyes; the leaves of *Alstonia theæformis* have been used as tea; and those of several of its allies, which are, like it, slightly astringent, might be employed to form a pleasant drink. The *Halesiæ* are the snow-drop trees of Carolina; and *Schopfia fragrans* is valued in Nipal for its sweet-smelling flowers.

(4350.) Belvisiaceæ. *Belvisia* and *Asteranthos,* formerly associated with the *Styraceæ,* have been separated by Dr. Brown, to form the rudiments of this, a new family, which, although not at present well understood, is sufficiently distinct to justify the separation.

(4351.) The *Belvisiaceæ* are shrubby plants, with alternate, simple, entire exstipulate leaves. The inflorescence is axillary, or lateral and solitary, and the flowers regular and united.

The calyx is synsepalous, the tube adherent to the germen, the limb divided and persistent; the corolla is synpetalous, plaited, with a many-lobed or undivided border, simple or double, staminiferous, and deciduous; the stamens are definite or indefinite, and exserted from the base of the corolla; the germen is inferior, style 1, stigma lobed or angular, and the fruit a many-seeded berry.

(4352.) Hence, differentially considered, the *Belvisiaceæ* are shrubby *Styracinæ,* with a plaited perigynous corolla, inferior ovary, persistent calyx, baccate fruit, and indefinite seeds.

(4353.) Of the properties and uses of these plants, which are natives of Africa, there is at present nothing known.

(4354.) Sapotaceæ. The *Sappodillæ* and their allies are trees or shrubs, with a soft wood, and in general lactescent juices; the branches are round; the leaves alternate, simple, entire, coriaceous, and petiolate, but destitute of stipules, the undersides of the leaves and young branches occasionally being covered by a shining, silky, or downy pubescence.

The inflorescence is axillary, and the flowers regular and united; the calyx is free, 4-8 cleft; the lobes imbricate in æstivation, sometimes disposed in a double series, and persistent; the corolla is hypogynous in its exsertion, deciduous, synpetalous, regular, and cleft; the lobes being equal in number to the sepals, and alternate with them, rarely two or three times as many, and biseriate; the æstivation is imbricate; the stamens are epipetalous, definite, and distinct, some being fertile, and some barren; the former opposite to the sepals, which they equal in number, the latter alternate with them, and often absent; the anthers are usually extrorse; the germen is superior, formed of several connate carpels, plurilocular, the cells uniovulate, and the ovules erect; the style 1, and the stigma simple, or occasionally lobed.

The fruit is fleshy, plurilocular, or by abortion 1-celled; the cells are monospermous; the seeds erect, nut-like, and coherent; the testæ hard, shining, and bony, and form by their cohesion a many-celled false putamen; the tegmen is opaque and soft; the embryo is erect, large, and white, albuminous or exalbuminous; when the former, often included; the cotyledons are foliaceous, when the albumen is present; when absent, they are thick, fleshy, and sometimes connate; the radicle is short, straight, or slightly curved, and turned towards the hilum; and the plumula is inconspicuous.

(4355.) Hence, selecting the chief differential characters, the *Sapotaceæ* are lactescent *Styracinæ*, with united regular flowers, hypogynous staminiferous corollæ, imbricate in æstivation; usually extrorse anthers; a fleshy many-seeded fruit, the seeds being erect, and having hard coherent testæ with large scars.

(4356.) The *Sapotaceæ* are remarkable among lactescent plants for being in general innocuous. They yield large quantities of milky sap, which is used for alimentary purposes; and the cow-tree of Humboldt [§ 1614] was once thought to belong to this group. Their fruit and seeds also abound in oil, which is solid, like butter, and of a mild, pleasant flavor. The concrete oil obtained from the fruit of the *Mahoa* or *Madhuca* tree, hence called *Bassia butyracea*, is used in Nipal as butter; and the *Galam* butter of Africa is the produce of this plant, or of another species of the same genus, and must not be mistaken for the *Bambara* butter, mentioned by Mungo Park, which is procured from the *Elais Guineensis*. [§ 1098.] Much of the *Palm oil* of commerce is likewise believed to be yielded by the *Bassiæ*, or other *Sapotaceæ*. The branches of *B. longifolia* are so oleaginous that they are used as flambeaux; the juices extracted from its bark are recommended by the Indian physicians to relieve rheumatic affections; and by the Africans the oils of these plants are used in large quantities to anoint their bodies, as well as to mix with their food. The flowers of *B. longifolia, latifolia,* and *butyracea,* are all fragrant; a pleasant drink is made by infusing them in water, and this infusion, when fermented, becomes an intoxicating liquor, whence spirit is procured. Arrack also is often distilled with the flowers of the *Bassiæ*, to give it a pleasant smell and flavor; the oil from their seeds is likewise used for burning, and for making soap.

(4357.) The fruits of the several species of *Achras, Chrysophyllum, Mimusops,* and *Inocarpus,* are eatable, and more or less prized in different countries. *A. Sapota,* and its variety *Zapotilla,* are commonly known as the sapodilla plum and naseberry. *Inocarpus edulis* is the *Tahiti* chesnut. The different species of *Chrysophyllum* are the star-apples and Surinam medlars of Europeans; and

Mimusops Elengi, and *M. Kauki*, retain their native appellations as specific names. The milky sap of *Achras mammosa* is said to cause vomiting; and the bark of other species is so astringent and bitter, that it is reputed to be equally efficacious as a febrifuge with cinchona.

(4358.) *Argania sideroxylon* is the old *Elæodendron argan*, the pulpy olive-like fruits of which yield abundance of oil. *Sideroxylon inerme* and *tomentosum*, which afford the iron woods of the Cape of Good Hope and the East Indies, also deserve notice, as exceptions, by the hardness of their timber, to the general character of this type; and, as it were, anticipating one peculiar property of the next, the *Ebenaceæ*.

(4359.) Ebenaceæ. The *Ebony*, and its present admitted immediate allies, are trees or shrubs, with hard dense wood and aqueous juices; their branches are round, leaves alternate, simple, entire, coriaceous, shortly petiolate, obscurely articulated with the stem, and exstipulate. The inflorescence is axillary, the peduncles solitary, those bearing stamineous flowers divided, those bearing pistilline ones usually 1-flowered, and with minute bracteæ. The flowers are regular, sometimes united, but in general separate, either being polygamous or diœcious.

The calyx is free, synsepalous, 3-6 cleft, nearly equal and persistent. The corolla hypogynous, synpetalous, 3-6 lobed, subcoriaceous, for the most part pubescent externally, and smooth within, imbricate in æstivation, or slightly contorted to the left, and deciduous. The stamina are definite, hypogynous, or epipetalous, 2 or 4 times as many as the segments of the corolla, or equal in number, and then alternate with them. The filaments are simple in the united flowers, but in the stamineous ones generally double, and then each division is antheriferous, but the inner one the smallest. The anthers are innate, erect, lanceolate, 2-celled, dehiscent lengthwise by chinks, and sometimes bearded. The pollen is round and smooth, the germen is free, sessile, and without any disk, plurilocular, the cells 1-2-ovuled, and the ovules pendulous from the tops of the locules. The styles are several, and discrete towards the summit, but often connate below; the fruit is fleshy, round or oval, often by abortion few-seeded; the pericarp drupaceous, and sometimes regularly dehiscent. The testa is membranaceous, and not distinct from the substance of the seed. The albumen is white and cartilaginous. The embryo axile or slightly oblique, straight and white; the cotyledons foliaceous, slightly veined and parallel; the radicle round, long, or of medium length, and turned towards the hilum; the plumula inconspicuous.

(4360.) Hence, differentially considered, the *Ebenaceæ* are non-lactescent *Styracinæ*, with hard, heavy wood, regular separated flowers, hypogynous corollæ, 3-6 lobed, and imbricate in æstivation; stamens definite, hypogynous, or epipetalous; fruit superior, fleshy, and plurilocular; seeds few, pendulous, and furnished with cartilaginous albumen.

(4361.) The former association of the *Ebenaceæ* with *Styrax* and *Guaiacum* shews their affinity with both those groups, as well as with the *Ternströmiaceæ* and *Oleaceæ*, to all of which they have evident affinities, but not sufficient to warrant closer connexion being retained. The hardness and darkness of the wood of these plants is their most remarkable character; hence one genus is called *Ferreola*, or iron-wood; and ebony has become almost another

word for blackness. It is the centre of the trunk, or heart-wood, which is the only valuable part; and, from its hardness, colour, durability, and the fine polish it takes, it is in much request for the purpose of inlaying, and other ornamental work. The wood of *Diospyrus Ebenum,* the black ebony, is the most prized; but there are ebonies of other colours, as red, green, and yellow. The true ebony, *Diospyrus Ebenum,* is a native of Madagascar, the Mauritius, and Ceylon, whence our chief supplies are brought. In 1828 upwards of 2,000,000 lbs. of ebony were imported from the Mauritius, of the estimated value of 9,017*l.* 7*s.* 0½*d.* Its price in the London market varies from 5*l.* to 20*l.* per ton.

(4362.) The fruits of most of the species of *Diospyrus* are eatable when fully ripe, but when immature they are remarkable for their acerbity; they are commonly known as date-plums, and some, as those of *D. amara,* are dried in China, and brought to Europe as a sweetmeat. *D. Kaki* is the keg-fig of Japan; it tastes like a plum, but, if eaten freely, is thought to bring on diarrhœa. The wood of *D. Lotus* is reputed to possess sudorific powers; and the bark of *D. Virginiana* is said to be a powerful astringent and febrifuge.

(4363.) *Gesneria* and its allies, which, by the artificial character of a perigynous corolla, belong to Jussieu's pericorollous class more correctly than several groups which are included in it, is, however, on account of its more important connexions with the labiate *Primulosæ,* referred to the succeeding suborder; for neither the names nor characters of these groups are inconsistent with such an arrangement, the diagnostic terminology, and attempted use of the natural system as an index, being often the chief obstacles to a truly natural arrangement.

PRIMULOSÆ.

(4364.) The remaining synpetalous exogenæ or dicotyledons are included in this section, which, from the well-known genus, *Primula,* (the primrose), may be called the Primulosæ. This group is therefore equivalent to the hypocorollous monopetalæ of Jussieu, with the exception of the *Gesneridæ,* and nearly equivalent to the corolliflorous dichlamydeæ of De Candolle; the *Styracinæ,* and most of the *Ericinæ,* already stated to be of dubious location, being associated with this latter series by him and his disciples.

(4365.) Hence, collectively considered, the *Primulosæ* are hypocorollous *Syringales,* or synpetalous dichlamydeous exogenæ, with staminiferous hypogynous corollæ; the petals seldom discrete, very rarely absent; the germen superior, and free, and the seeds in general dicotyledonous.

(4366.) The genera included in this suborder have been associated to form twenty natural families or types, and these are distributable into five sections, which, from *Mentha, Solanum, Gentiana, Primula,* and *Plantago,* may be called *Menthinæ, Solaninæ, Gentianinæ, Primulinæ,* and *Plantaginæ;* the two latter of which are sometimes conjoined.

MENTHINÆ.

(4367.) The *Personatæ* and *Verticillatæ* of Linneus, which were divided by Jussieu into his orders *Pediculares, Acanthi, Bignoniæ, Labiatæ, Scrophulariæ,* and their allies, have been still further divided, and many modifications of their limits introduced by succeeding botanists, some distinguishing as many as fourteen different orders. These, however, do not seem in general to be more than

subtypical groups; and hence eight types are all that are admitted here. Bartling, from the more or less irregular and usually ringent form of the corollæ, calls this group *Labiatifloræ;* but, as the flowers are not all truly labiate, and as De Candolle applies the same term to a part of his compositæ, (§ 4263), it had better be altogether abolished, and the section be named, from its normal genus *Mentha*, the *Menthinæ*.

(4368.) The eight types included in this section are called *Gesneriaceæ*, *Orobanchaceæ*, *Acanthaceæ*, *Bignoniaceæ*, *Verbenaceæ*, *Menthaceæ*, *Utriculariaceæ*, and *Scrophulariaceæ*, from the respective normal genera of each.

(4369.) Collectively and differentially considered, the *Menthinæ* are non-lactescent *Primulosæ*, with mostly simple leaves, destitute of stipules, irregular flowers, corolla often labiate, stamina definite, in general didynamous; carpels 4, or when 2 incumbent, *i. e.* axial, and abaxial in their position.

(4370.) Gesneriaceæ. Two subtypes, the *Gesneridæ* and *Bessleridæ*, are here associated together; for, although they differ in the chief diagnostic character, viz. the superior or inferior fruit, still in most other respects their structure is the same; the adhesion of the calyx to the germen in *Gesneridæ*, and its freedom in *Bessleridæ*, being the only essential difference.

(4371.) The *Gesneriaceæ* are herbaceous plants, or shrubs, with the leaves opposite, simple, rugose, and exstipulate. The inflorescence is spicate, racemose, or paniculate, seldom solitary; the flowers irregular, united, and specious.

The calyx is free, semi-adherent, or adnate to the germen, 3-cleft and persistent, and valvate in æstivation. The disk is annular, perigynous, and studded with glands. The corolla is perigynous or hypogynous, synpetalous, irregular, 5-lobed, sub-bilabiate, the upper lip 2-lobed, the lower 3-lobed; deciduous, and imbricate in æstivation. The stamens, 4 and didynamous, are exserted from the tube of the corolla, and alternate with its lobes, the upper one being absent; sometimes, as in *Sarmienta*, the flowers are diandrous. The filaments are free, the anthers 2-celled, innate, and dehiscent lengthwise by chinks. The germen is formed of 2 connate carpels, 2-valved, 1-celled, with 2 lateral placentæ, and many ovules. The style 1, and the stigma capitate or concave.

The fruit is capsular or fleshy, 1-2-celled, inferior, half-inferior or superior, with a loculicidal dehiscence, the carpellary leaves being axial, and abaxial in their position, and hence the placentæ right and left. The seeds are indefinite, and very small, but with elongated podosperms; the testæ thin and obliquely veined; the embryo minute, erect, and axile; and the albumen fleshy.

(4372.) Hence, differentially considered, the *Gesneriaceæ* are deviating *Menthinæ*, the calyx being inferior or superior, the corolla more or less irregular, the stamens didynamous, the stigma capitate, the fruit 2-valved, 1-celled, with 2 lateral, projecting double parietal placentæ; indefinite, minute, pedicled seeds; fleshy albumen, and erect axile embryo.

(4373.) The two subtypes, *Gesneridæ* and *Bessleridæ*, shew by their differences the questionable situation of the type; for

(4374.) In the *Gesneridæ*, including *Gesneria*, *Gloxinia*, *Eriphia*, *Pentarrhaphia*, &c. the calyx is adherent to the germen;

(4375.) While in the *Bessleridæ* the germen is free.

(4376.) The *Gesneriaceæ* are very ornamental plants, both leaves and flowers being beautiful, but their economical value is little; some have been used as

dyes, and the fleshy fruits of others are eatable; they are sweetish and mucilaginous, but not much prized.

(4377.) Orobanchaceæ. *Orobanche* and its allies are so similar in general characters to the preceding type, that, were it not for their parasitic habit and leafless stems, they might well have been conjoined as a subtype.

(4378.) Collectively considered, the *Orobanchaceæ* are herbaceous plants, growing parasitically on the roots of annual or perennial herbs or shrubs. Their stems are round and simple, or slightly branched, coloured, and destitute of leaves; instead of which, they are covered with brownish scales, sometimes dry and sometimes fleshy.

The inflorescence is spicate or racemose, rarely solitary; the flowers irregular and united, or occasionally polygamous; the calyx is inferior, synsepalous, variously divided, and persistent; the corolla hypogynous, synpetalous, irregular, tubular, or subcampanulate, with a 2-lipped limb, the upper lip bifid or entire, the lower, in general trifid; the stamens 4, and didynamous, exserted from the tube of the corolla alternate with its lobes, the upper stamen being abortive; the filaments are free; the anthers subinnate, 2-celled, the locules distinct at the base, and often appendiculate or bearded; dehiscent lengthwise by chinks, and the pollen spherical; the germen is formed by 2 incumbent connate carpels, and

Orobanche ramosa.

(*a*) Seed of orobanche beginning to germinate.

(*b*) Ditto, with two rootlets protruded in water.

(*c*) Ditto, bursting through the envelope.

(*d*) Ditto, with roots protruding.

(*d*) The same magnified.

(*e*) Ditto, in an early stage of development.

(*e*) The same magnified.

(*f*) A farther stage of development.

(*f*) The same magnified.

(*g*) A full-grown plant parasitic on the root of the hemp.

(*h*) The stem and roots of the hemp.

(*g h* bis) Staminiferous synpetalous corolla, germen, style, and stigma.

by the abortion of the dissepiment, usually 1-celled, or sub-bilocular; the placentæ are 4, and nerviform, sometimes spongy, parietal, and multiovulate; the style 1, and cylindrical; and the stigma thick, and 2-lobed.

The fruit is capsular, enclosed by the marcescent corolla, 1-celled, rarely sub-bilocular, 2-valved, with a loculicidal dehiscence, and the valves placentiferous;

the seeds are indefinite, minute, roundish, and sessile; the embryo minute and inverted, and seated at the apex of the albumen, which is fleshy.

(4379.) Hence, differentially considered, the *Orobanchaceæ* are parasitic colourless *Menthinæ*, destitute of leaves, with irregular unsymmetrical flowers, appendiculate anthers, spherical pollen, a superior 1-celled ovary, lateral placentæ, indefinite, albuminous, sessile seeds, and an inverted embryo.

(4380.) The *Orobanchaceæ* are bitter and astringent plants, and have been used as detergent applications to foul sores, and internally to restrain alvine fluxes. Michaux says that in Virginia the powdered stems of *O. Virginiana* are frequently sprinkled over inveterate ulcers and open cancers, with considerable benefit; and "Martin's Cancer Powder," so much bepraised by the lovers of empiricism in North America, is said to be a compound of this plant and white arsenic.

(4381.) *Orobanche*, called *Broomrape* by our herbalists, on account of the ravages it is thought to commit on the *Genistæ*, *Cytisus*, &c. received its generic name, *Orobanche*, from its strangling, as it were, or destroying the vetches and other plants on which it grows. We are told that, where these parasites abound, they really create a desert. Thus, in many parts of Flanders, the farmers are altogether deterred from the cultivation of clover by the *O. major*, as the crops, when sown, are devoured by the parasite. Hence it seems well to deserve its old Roman name, *Herba leonina*. But it is less injurious to the shrubby brooms, which, if they are ravished, they are not destroyed. By some persons the *Orobanches* have been supposed to partake of the qualities of the plants from which they derive their sustenance, but this is without sufficient proof. Formerly it was believed, on the contrary, that they imparted a deleterious quality to the vegetables on which they grew. Thus, we are told by Smith, that the Greeks rejected the beans on which the *Orobanche* is found, believing them to have become unwholesome as food; and this, should the many other reasons given not seem sufficient, may perhaps account for certain ancient philosophers having forbidden their followers the use of beans.

(4382.) The different species of *Orobanche* do not grow indifferently on any plants, but each infests a peculiar tribe of vegetables. *O. major* is found chiefly on the leguminosæ, such as the broom, furze, and clover; *O. elatior* on certain compositæ, as *Centaurea nigra*, *C. Scabiosa*, and *Scabiosa arvensis*; *O. minor* occurs both on the red clover (*Trifolium pratense*), and the cat's-ear (*Hypochœris radicuta*), and *O. ramosa*, on the roots of hemp. The seeds of the *Orobanches* are known to lie dormant in the soil for years, until they meet with fit roots on which to grow; and this, a long current opinion, has been proved by Vaucher, of Geneva, from direct experiments. [Vide fig. § 4378.]

(4383.) The *Orobanchaceæ* are interesting not only in their general natural history, but also for their connexion, through Monotropa and the other aphyllous *Pyrolidæ*, with the *Ericaceæ*; and their 2-celled appendiculate anthers afford another coincidence in structure.

(4384.) Acanthaceæ. The *Acanthus* type are herbs, undershrubs, or shrubs, chiefly tropical; the stem sometimes twining, and the younger branches nodoso-articulate. The pubescence, when present, simple, rarely stellate or capitate; the leaves opposite (seldom quaternate), simple, undivided, rarely sublobed, entire, or serrate, sometimes very small or abortive, and destitute of stipules.

The inflorescence is terminal or axillary, spicate, racemose, paniculate or fasciculate, rarely solitary; the pedicels often opposite and tribracteate; the

bracteæ are often large and leafy, and enclose a diminished calyx, which sometimes is obsolete, and the two lateral bracteæ are occasionally abortive; the flowers irregular and united.

Acanthus mollis.

A. Cutting, to shew inflorescence.

(*a*) A flower opened, to shew the corolla, stamens, and pistil, with the 2 lateral divisions of the calyx.

(*b*) The fruit, invested with the calyx and bracteæ.

(*c*) Ditto, when mature, and deprived of its adventitious coverings.

(*d*) Seed opened, to show the position of the radicle.

The calyx is free, persistent, synsepalous, equal or unequal, cleft or tubular, with a 4-5 parted, occasionally a multifid limb, sometimes however entire, and sometimes obsolete. The corolla is hypogynous, synpetalous, deciduous, and staminiferous, 5-lobed, and for the most part irregular; the limb bi-labiate, the under lip overlapping the upper in æstivation, sometimes 1-lipped, and at others nearly equal; the stamens are exserted from the tube of the corolla, in general 2, sometimes 4, and didynamous, when the shorter ones (which are anterior) are occasionally sterile; a rudiment of a 5th stamen is sometimes found: the anthers are either 1-celled, or, when 2-celled, with the cells equal or unequal in their exsertion, and dehiscent lengthwise by chinks; the torus is annular or discoid, glandular, hypogynous, and surrounding the germen, which is formed of 2 (rarely 4) incumbent connate carpels, 2 or 4-celled, the dissepiment being double as it springs from the sides of the pericarp; the placentæ are 4, and nerviform, on the edges of the dissepiment, hence sometimes subcentral, and the cells 1, 2, or many-ovuled; the style 1, and the stigma 2-lobed, or rarely undivided.

The fruit is superior, for the most part capsular, rarely baccate or drupaceous, 2 (seldom 1) celled, or spuriously 3-celled, and dehiscent elastically by 2 valves, the dissepiment opposite the valves, and separable into two pieces through the axis, (the middle being sometimes open,) these pieces being attached to the valves, or sometimes separating from them elastically, entire, or spontaneously separating into 2 plates, the inner edge being placentiferous; the cells are 2, or by abortion 1 seeded, sometimes polyspermous; the seeds are roundish, and hanging from ascending subulate processes of the dissepiment; the testa loose, but not

winged; the albumen absent; the embryo curved or straight, the radicle descending, centripetal, (rarely superior), turned towards the hilum; the cotyledons large, suborbiculate, or semiterete, and foliaceous during germination.

(4385.) Hence, differentially considered, the *Acanthaceæ* are *Menthinæ*, with bracteate, irregular, unsymmetrical flowers; a 1-2 celled superior capsular fruit, sometimes spuriously 4-6-8 celled, central placentæ, and exalbuminous wingless seeds.

(4386.) The genera thus associated are distinguishable into three subtypes, which, from *Acanthus*, *Cyrtandra*, and *Sesamum*, are called the *Acanthidæ*, *Cyrtandridæ*, and *Sesamidæ*.

(4387.) In the first, the *Acanthidæ*, the fruit is a 2-celled capsule, with hooked dissepiments, rarely, as in *Mendozia*, a 1-seeded drupe, with crumpled chrysaloid cotyledons;

(4388.) While in the second, the *Cyrtandridæ*, the fruit is a 1 or spuriously 2 celled capsule (rarely becoming fleshy), with bilamellate diverging dissepiments, hookless placentæ, and naked or comose seeds. They are also sometimes parasitical;

(4389.) And in the third, the *Sesamidæ*, the fruit is 1-celled, or spuriously 2-8 celled, dry and woody, ligneous lobed placentæ, seeds definite or indefinite, with papyraceous testæ.

(4390.) *Acanthidæ.* The normal genus of this subtype possesses some classical celebrity, from the legend, that to its growing accidentally round a basket we owe the highly decorated Corinthian capital, some of the ornaments of which are to this day hence named *Acanthi*. The *Acanthidæ* are mucilaginous and mildly bitter plants, and several are likewise slightly aromatic. Thus *Acanthus mollis*, and *Justicia biflora*, and *Peruviana*, have been made into emollient cataplasms; and *A. ilicifolius* of Linneus, which is considered an alexipharmic by the Hindoos, is eaten by the Arabs as a common potherb: it has therefore been named by some writers *A. edulis*. *J. pectoralis* is made into a syrup or confection in the West Indies, where it is esteemed a stomachic. *J. Adhatoda* is extolled by the Hindoo practitioners as an antispasmodic, and its wood is said to make good charcoal for the manufacture of gunpowder. *J. Ecbolium* and *echioides* are both commended as diuretics. *J. Gendarusa* is affirmed to have emetic powers, and its leaves and young shoots, when bruised and roasted, are thought to be serviceable in chronic rheumatism; they have a strong but not unpleasant odor. The leaves of *J. procumbens* and *triflora* have been used in infusion as ophthalmic lotions. *J. Tranquebariensis* is said to be aperient and cooling, and is administered in India during the progress of small-pox; its leaves form also topical applications to bruises. *J. paniculata* is the *Ho-ang-lien* of the Chinese, and the *Chucum* or *Creyat* of the Hindoos. It has been much celebrated as a stomachic, and used as a remedy for cholera and dysentery, and in intermittent fevers; and it enters into the composition of the *drogue amere* of the French. On the Malabar coast it is called *Nella Vaymbo* or *Cara-caniram*, and is esteemed as an antidote to the bite of the *cobra de Capello*. *J. bicalyculata* is also considered an alexipharmic. The roots and leaves of *J. nasuta* are affirmed by the Hindoo doctors to be a sovereign remedy for ringworm, and other disorders of the skin; and those of *J. repens*, steeped in castor oil, to be one of the best applications to scald heads. The leaves of *J. purpurea* have been employed in Mexico as a dye; and those of *J. tinctoria* are used in Cochin-china for a similar purpose.

(4391.) In *Thunbergia*, *Mendozia*, and *Clistax*, the calyx becomes degenerate and almost obsolete, a mere ring indicating its existence, so that the flowers become apparently monochlamydeous, and the place of the sepals is supplied by bracteæ. The drupaceous fruit of *Mendozia* anticipates that of the *Sesamidæ*.

(4392.) *Cyrtandridæ*, or *Didymocarpidæ*. Some of the *Cyrtandridæ* being parasitic, thus shew an interesting affinity in habit to the foregoing type, the *Orobanchaceæ*, and in general structure they exhibit, as will be seen, a very close connexion with the *Gesneriaceæ*, which precede, and the *Bignoniaceæ*, which follow, agreeing with them in habit, and scarcely differing from the former excepting in never having any tendency to produce an inferior germen, their lobed placentæ and exalbuminous seeds; and from the latter, in their herbaceous port, wingless seeds, 1-celled ovary, and 2 double placentæ. Of their properties there is at present nothing known.

(4393.) *Sesamidæ*, or *Pedalidæ*. These plants are all innocuous, and some, as *Sesamum* and *Pedalium*, are used both as food and medicine. They are chiefly remarkable for the abundance of bland oil contained in their seeds, which is as sweet and tasteless as that of olives or almonds, and is expressed in the Levant and other Oriental countries for domestic use. This oil is called by the Arabs *Siritch*. Herodotus mentions the esteem in which it was in his time held by the Babylonians; and Dioscorides says sesame oil was highly valued by the Egyptians, who used it both to eat and burn, and their females as a cosmetic. The marc of the seeds, after the oil has been expressed, is called in Egypt *Tahiné*, and, when mixed with honey and lemon juice, it is eaten by the poorer people. The leaves are emollient, and have been used as poultices. The seeds of *S. Indicum* and *trifoliatum* also yield large quantities of oil. The leaves when dried are likewise eatable, and a sort of pudding is made in Carolina, where the latter plant is naturalized, from its seeds. The fresh leaves of *Pedalium Murex*, when steeped in water, render that fluid viscid, and form a mucilaginous drink, which the Indian doctors recommend in dysuria; the seeds are also administered in similar complaints.

(4394.) The *Sesamidæ* are easily distinguishable from the *Bignoniaceæ*, with which they were formerly associated, by their wingless seeds and curious falsely plurilocular fruit, as well as by their herbaceous port; by their large definite seeds they will readily be known from *Cyrtandridæ*, with which, however, they are connected by *Sesamum* having definite seeds.

(4395.) Bignoniaceæ. *Bignonia*, *Catalpa*, *Jacaranda*, and their allies, are trees or shrubs, with often twining or scandent stems, opposite compound leaves (rarely alternate or simple), and destitute of stipules, but often cirrhiferous.

The inflorescence is terminal in panicles, or compound racemes, seldom solitary, and the flowers mostly irregular, unsymmetrical, and united.

The calyx is free, synsepalous, the limb cleft or entire, and sometimes spathaceous. The corolla hypogynous, synpetalous, usually irregular, 4-5-lobed or sub-bilabiate, the lobes imbricate or plicato-imbricate in æstivation, and deciduous. The disk is annular, hypogynous, and surrounding the germen. The stamina (5) are epipetalous, exserted alternately with the lobes of the coralla, and unequal: the lower ones equal in pairs, the fifth shortest, and often abortive, sometimes the upper three sterile; the filaments are free, the anthers 2-celled, the locules equal, discrete, deflected or divaricate, rarely erect, and parallel, and dehiscent longitudinally by chinks. The germen is formed of 2 connate carpels surrounded

by the annular disk, 2-celled or spuriously 4-celled, and many-ovuled. The style 1, and the stigmata 2, or bilamellate.

The fruit is capsular, 2-celled or imperfectly 4-celled, 2-valved, and often long and flattened: the central column much compressed, the dissepiment either parallel with the valves or in a contrary position, and becoming ultimately free, bearing the nerviform placentæ on its edges at the commissure along with the valves. The seeds are indefinite, transversely compressed, often winged and exalbuminous, the embryo straight, the radicle short, turned towards the hilum, and therefore centrifugal, and the cotyledons foliaceous.

(4396.) Selecting the chief differential characters, the *Bignoniaceæ* are arborescent *Menthinæ*, with mostly compound leaves, irregular unsymmetrical flowers, a 2- (rarely 1- or spuriously 4-) celled capsule, and compressed foliaceous winged seeds, destitute of albumen.

(4397.) The *Bignoniaceæ* differ so little from the *Sesamidæ* and *Cyrtandridæ*, that their union as a subtype to the *Acanthaceæ* would not be unjustifiable. The arborescent port, one of the most obvious differences, is wanting in *Eccremocarpus*, which is furthermore an aberrant genus, by its fruit being 1-celled and its placentæ parietal. The winged processes of the compressed seeds are often of a most delicate and beautiful texture; and, taken with the arborescent growth, these organs form sufficiently constant distinctive signs, both being never absent. Besides their immediate sectional affinities the *Bignoniaceæ* are related to the *Polemoniaceæ* of the *Solaninæ*, by *Cobæa*, which is sometimes placed in one group, and sometimes in the other.

(4398.) Like many other groups with specious flowers, the *Bignoniaceæ* are of little economical or medicinal importance. None of them are known to be deleterious, and none have hitherto been used as food. The timber of several of the *Bignoniæ* is, however, hard and durable; and in Brazil, where vast forests of them abound, they are valued for ship-building, for carpentry, for making bows, and for basket-work. The leaves of *B. æquinoctialis* are applied to the painful tumours on the feet (*le crabe*), with which the negroes in the West Indies are troubled; and those of *B. Indica* are used as poultices to irritable ulcers. The juice of the root of *B. ophthalmica* is said by Dr. Chisholm to be serviceable in the disease which has suggested its specific name. *B. Unguis Cati* has been said to be possessed of alexipharmic powers, *B. Leucoxylon* to be an antidote to the poison of the manchineal; and from *B. Chica* the Indians extract a red ochreous colouring matter, which they use to paint their bodies with; they call it *Chica*, and it promises to become of some importance as a red or orange dye. The hard wood of *B. Leucoxylon*, which is of a green or yellow colour, is sometimes brought into the markets under the name of ebony, and that of *B. uliginosa*, which is spongy, is used in Brazil instead of cork. *Catalpa longissima* is reported to contain much tannin in its bark, and hence to be fit for the preparation of leather. Brere says that its decoction has proved serviceable in humoral asthma. The bark of *Tecoma pentaphylla* is valued in the Antilles as a febrifuge, and *T. Stans* is said to be a powerful diuretic. The bark of *Jacaranda Copaia* is reported by Aublet to be both emetic and purgative; and Thunberg states that in Japan an oil is extracted from the seeds of *J. tomentosa*. These trees have resplendent blue or purple flowers, and light acacia or fern-like foliage. Their timber is said to be excellent, and it is not improbable that the *Jacaranda* or

rose-wood of Brazil and the Bahamas, in general thought to be the timber of a Mimosa, is the wood of these *Jacarandæ*. [§ 2225.]

(4399.) VERBENACEÆ. This type includes, along with the *Verbenidæ*, the *Myoporidæ* and *Selaginidæ*, often regarded as separate orders, but which seem to be sufficiently distinguished when considered as subtypes of one common group; for, notwithstanding the ingenious argument raised in favor of their separation by Choisy, who institutes a comparison between them and three groups of the old Compositæ, now acknowledged to be distinct orders, viz. the *Dipsaceæ*, modern *Compositæ*, and *Calycereæ*, he omits all reference to the peculiar structure of the corollæ and stamens in these three last-named orders, which are equally important as differential characters with the relative position of the ovule, and the presence or absence of albumen. And, on the other hand, he appears to have paid too little attention to the fact, that in the *Verbenidæ* the ovules are very often pendulous, that the seeds are sometimes albuminous, and that the albumen in the *Selaginidæ* is occasionally spare. Hence he is scarcely correct when he says that "if we examine *Dipsaceæ*, *Compositæ*, and *Calycereæ*, on the one hand, and *Selagineæ*, *Verbenaceæ*, and *Myoporinæ*, on the other, we shall find a perfect symmetry between their respective characters; thus *Dipsaceæ* differ from *Compositæ* exactly as *Selagineæ* do from *Verbenidæ* by the inverted embryo and presence of albumen, and *Calycereæ* differ from *Compositæ*, as *Myoporinæ* from *Verbenidæ*, by their pendulous ovules: therefore, as every one admits the segregation of *Dipsaceæ* and *Calycereæ*, it seems natural to admit *Selagineæ* and *Myoporinæ*." Yes, as subordinate groups, but not as separate orders.

(4400.) The *Verbenaceæ*, thus collectively arranged, are herbaceous plants, shrubs, or trees, with opposite or alternate, simple or compound leaves, destitute of stipules.

The inflorescence is solitary or aggregate, spicate, capitulate or corymbiform, and the flowers irregular and united.

The calyx is free, synsepalous, tubular, with a divided limb, more or less irregular, and persistent. The corolla hypogynous, synpetalous, tubular, with a 5-lobed limb, more or less irregular, imbricate in æstivation, and deciduous. The disk is abortive. The stamens 4 (seldom 5), didynamous, sometimes only 2, exserted from the tube of the corolla, and alternate with its lobes, the fifth being in general abortive. The filaments are free, and the anthers adnate, rarely versatile, 2-celled, and dehiscent lengthwise by chinks. The germen is free, not surrounded by a ring-like disk, formed of 2 connate carpels, 2-celled, or 4-celled by the division of the locules. No central column, and the cells 1-2-ovuled. The style 1, and the stigma simple or scarcely divided.

The fruit drupaceous, sometimes dry and sometimes fleshy, 2-4-celled, or with 2-4 cocca. The cells and cocca separable or inseparable, and the seeds 2 or 4, rarely by abortion 1. Albumen none or fleshy, and the seeds erect or pendulous.

(4401.) Hence, selecting the chief differential characters, the *Verbenaceæ* are *Menthinæ*, with simple or compound leaves, irregular unsymmetrical flowers, sublabiate corollæ, didynamous stamens, germen not surrounded by a disk, and without a central column, the fruit 2-4-celled, the cells all regular, and the seeds definite and wingless.

(4402.) The secondary differences in structure, upon which the subtypes are founded, may be conveniently shewn by their definitions. Thus

(4403.) The *Selaginidæ* are herbs or small shrubs, with simple sessile leaves, unibracteate flowers, a dry subdrupaceous 2-celled fruit, solitary pendulous seeds, the embryo in the axis of fleshy albumen, and the radicle superior.

(4404.) The *Myoporidæ* are shrubs, with simple petiolate leaves, ebracteate flowers, indehiscent 2-4-celled fruit, the cells 1-2-seeded, the seeds pendulous, the albumen fleshy, and the radicle superior.

(4405.) The *Verbenidæ* are herbs, shrubs or trees, with simple or compound leaves, unibracteate flowers, indehiscent, 2-4-celled, drupaceous or baccate fruit, solitary seeds, in general erect, albumen none or very spare, and inferior radicle.

(4406.) Of the two subtypes, *Selaginidæ* and *Myoporidæ*, the properties are unknown, not a single species having been shewn to be either deleterious or useful, if the *Avicenniæ* be excepted, which, although removed by Brown to the *Myoporidæ*, are by most systematic writers referred to the *Verbenidæ:* thus shewing the close affinity between these groups. The genus called *Selago* by Linneus has no relation whatever to the ancient Druidical selago [§ 844], and the name has, to say the least, been very ill applied.

(4407.) *Avicennia tomentosa* is the white mangrove of Brazil, and in Rio Janeiro its bark is in great request for tanning. *A. resinifera* is said by Forster to yield a green resinous substance that is eaten by the New Zealanders, who relish it much as food.

(4408.) VERBENIDÆ. The *Vervain* was a sacred plant among the Greeks, and in the Druidical superstitions it was regarded with reverence: being never

C

Verbena mutabilis.

c. Cutting, to shew leaves and flowers.

(*a*) Calyx and pistil.

(*b*) Corolla opened, to shew the stamens.

(*c*) The calyx opened, to shew the fruit.

(*d, e*) Two views of one of the cocca or carpels.

(*f*) Transverse section of the same, to shew the solitary seed.

gathered without religious ceremonies, almost equal in solemnity to those performed on the collection of the mistletoe. To these ancient superstitions it pro-

bably is that the *Vervain* still maintains some repute as a medicine, and long was esteemed a most potent ingredient in love philtres: its name, we are told, by such as delight in absurd etymologies, being a corruption of *Veneris Vena.* De Theis says that in Celtic it is called *ferfaen.* It is slightly bitter and astringent, but its reputed influence over disease or passion, it need not be said, is altogether imaginary. *V. Lamberti* and *V. Aubletia* are ornamental flowers; the others are very homely plants.

(4409.) *Vitex Agnus Castus* is the chaste-tree, so called from an old belief of its power of subduing unchaste desires. Hence the Athenian matrons used to strew their couches with its leaves during their observance of the sacred rites of Ceres: hence also its Greek name *Agnus* (αγνος), and its Latin translation *castus*, which during the barbarous ages were pleonastically conjoined. It has likewise been called *Piper Monachorum* and *Eunuchorum;* but in modern times it has been ascertained that the seeds at least, if not the leaves, are carminative and emmenagogue, anything, in fact, rather than anti-aphrodisiac. *V. trifolia* is said to have similar properties to the *V. Agnus Castus.*

(4410.) The Brazilian tea, sometimes used as a substitute, and sometimes to adulterate that of China, consists of the dried leaves of *Stachytarpheta Jamaicencis;* the bastard Vervain of Brazil: a plant which in the New World is venerated as much, and with as little reason as the Vervain itself was once in the Old. An infusion of the leaves of *Lantana macrophylla* is said by Martius to have exhilarating properties, and to be drank as an exciting beverage in Brazil, where the leaves of *L. pseudo-thea* are used as a substitute for our ordinary tea. The leaves of *L. salviæfolia* are made into poultices in Chili; and several species, such as *L. Camara* and *aculeata,* are mentioned by Pison as being employed to impregnate baths, and to relieve diseases of the skin.

(4411.) *Premna integrifolia* and *P. quadrifolia* are both cordial and stomachic; the latter is much used by the negroes of the Gambia, and the former is esteemed in India for removing flatulence and headach; and so effectual is the relief it affords, that Commerçon tells us it is called *Arbre à la migraine.*

(4412.) The flowers of *Callicarpa acuminata* are esteemed in New Grenada as aperient and sudorific; and the Cingalese chew the bark of *C. lanata,* which is slightly bitter and aromatic, as a substitute for the betel; the Malays believe it to be diuretic, and in Java it is used as an emollient.

(4413.) The *Teak,* called *Tekka* on the Malabar Coast, and *Tectona* by botanists, is one of the noblest trees in Oriental forests, proverbial for the luxuriance of their vegetation. Its trunk rises to the gigantic height of 200 feet and upwards, and its leaves are twenty inches long by sixteen broad. In Java, Ceylon, and on the Peninsula of Hindustan, it forms vast forests; and large supplies of its timber, which is hard and durable, are brought to our settlements on the coast, from Ava and Pegu. Some of the finest vessels, almost equal, and in some points superior, to those of oak, have been built at Calcutta and Madras of teak-wood, which, although less tough and strong than good oak, is less liable to be preyed on by the worm. The flowers are said to have diuretic properties; and its leaves, which are astringent, yield a red juice, that has been recommended as a dye-stuff.

(4414.) Menthaceæ or *Labiatæ.* This extensive and very natural group was

named by Linneus *Verticillatæ*, from the prevalent verticillastrous arrangement of the flowers, and *Labiatæ* by Jussieu and others, from the ordinary form of the corollæ. But although in both instances it agrees generally with the expressed characters, yet the old names are scarcely tenable; for the inflorescence is never truly verticillate, and the labiate corolla is not peculiar to this series, all the other types in the section, not to dwell on the *Mutisiaceæ* or *Labiatifloræ* of De Candolle, being more or less distinctly labiate likewise; while some of these, such as *Mentha*, *Lycopus*, and their typical allies, are scarcely irregular in their

Salvia formosa.

B. Cutting, to shew opposite leaves and flowers.

(*a*) Calyx 2-lipped.

(*b*) The corolla opened, shewing the 2 fertile and the rudiments of the 2 abortive stamens.

(*c*) The pistil, with the style rising from the centre of the deeply-lobed germen, seated on the hypogynous disk.

(*d*) The calyx opened, to shew the fruit.

(*e*) One of the akenia.

(*f*) Section of the same, shewing the conformable seed and obscure pericarp.

(*g*) The seed removed.

outline. Hence, as in other similar straits, *e.g.* the *Umbelliferæ* and *Compositæ*, it is proposed to name the type *Menthaceæ*, from the well known genus *Mentha*, the mint, notwithstanding the other terms have antiquity to cloak their errors.

(4415.) The *Menthaceæ*, collectively considered, are herbaceous or suffrutescent, rarely shrubby plants, with the young stems, and branches square and nodoso-articulated, and the ramifications opposite. The leaves are opposite, rarely ternate or whorled, simple entire or divided, sessile or petiolate, destitute of stipules, and furnished with numerous receptacles for the fragrant oil.

The inflorescence is thyrsiform, the flowers being collected in opposite axillary cymes or verticillastri, the thyrsi being sometimes depauperate and sometimes congested; the flowers are irregular and united.

The calyx is free, synsepalous, regular or irregular, tubular, with 5-10 teeth and 5-10 ribs, or bilabiate, the uper-lip 3-toothed, the lower bidentate (or rarely entire), hence the fifth sepal is axial in its position. The corolla is hypogynous, deciduous, synpetalous, with a quinquifid bilabiate limb, the lobes being arranged alternately with the lobes of the calyx, hence the upper lip is formed of 2 petals

and the lower of three, the fifth being abaxial. The upper lip is entire or cleft, and during æstivation overlaps the lower, which is 3-lobed, and incurved in the bud. The disk is fleshy, hypogynous, situated on the base of the calyx, free, and often cylindrical. The stamens are 4, didynamous, exserted from the corolla, alternating with the lobes of the lower lip, the fifth (or axial) stamen being wanting, and sometimes the upper pair are also sterile or abortive. The filaments are free, the anthers terminal, 2-celled, the locules often divaricate, and sometimes apparently 1-celled by the confluence of the locules at the apex, and occasionally 1 cell is altogether absent. The germen is free, formed of 4 or rather of 2 bipartite carpels, seated on a fleshy disk, each lobe containing a solitary erect ovule. The style is single, arising from the centre and base of the deeply 4-cleft ovary, the stigma bifid, often unequal, and usually acute.

The fruit (a *Tetrakenium*) consists of 4 (or by abortion fewer) small nuts or akenia, mostly dry, but sometimes subdrupaceous, and enclosed by the persistent calyx. The seeds are solitary, erect, and exarillate, of the same shape as the akenia, and with very little or no albumen. The embryo is erect, straight, rarely replicate, the radicle inferior and the cotyledons plane, and foliaceous during germination.

(4416.) Hence, differentially considered, the *Menthaceæ* or *Labiatæ* are herbaceous or suffrutescent *Menthinæ*, with square stems or branches, opposite leaves, verticillastrous, irregular, unsymmetrical flowers, mostly didynamous stamens, a deeply 4-lobed fruit (*Tetrakenium*), and erect solitary seeds.

(4417.) The strict adherence of the *Menthaceæ* to the normal characters of the type must be obvious to every one. Indeed, so striking is their similitude, that Jussieu observed they might be considered as forming a vast but single genus; and to this uniformity of structure may perhaps be attributed their equally remarkable similitude in properties. None of the *Labiatæ* are poisonous, nor are any even suspected of being injurious; the betony is the most acrid of the whole. Scarcely any are used as ordinary food, although many form grateful condiments; the stachys and the basil being perhaps the only ones that are esculent as pot-herbs. They are all more or less fragrant, most are sweet-scented, but some are fœtid. Their odors are in general owing to the essential oils which are secreted in abundance, and found in numerous receptacles on their leaves and stalks. Fee observes, that odoriferous plants exhibit three remarkable variations; in some, the aromatic principle is free, and then it is dissipated by drying; this occurs chiefly in flowers, such as in the tuberose and jasmine, and it is not communicable either to water or spirit, and seems to be artificially retained only by the aid of fixed oils; and occasionally, as in the lily and narcissus, it cannot be retained at all. In some the aromatic principle is in union with, or is peculiar to the essential oil, with which the utricles or cryptæ are replete; and in this form it is miscible with water and alcohol, but scarcely with fixed oils. In others again, it is in combination with a resin or gum-resin, and then it may be collected in concrete masses by wounding the plants, or if by distillation, it deposits camphor after standing for some time. The fragrance of the *Labiatæ* is dependent on an essential oil or odoriferous principle of the latter kind, and their oil is remarkable for the quantity of camphor it contains. Besides the essential oils which render them stimulating, the *Menthaceæ* likewise contain a bitter principle, which occasionally is so predominant as to render them useful tonics, and even serviceable

febrifuges. Such being their common and almost universal properties, the illustrations of the several subtypes will contain little more than a repetition, or an account of the degree in which the aromatic and bitter principles are respectively evolved.

(4418.) Of the various methods devised for the subordinate distribution of the numerous genera included in this very extensive type, that proposed by Mr. Bentham, an outline of which was published in the Botanical Register for 1829, (fol. 1282, 1289, 1292, and 1300,) is by far the most satisfactory and complete, being, as it is, not merely a scheme of arrangement, but conveying much information as to the peculiar structure of the several subdivisions of these curious plants. A sketch of it, reduced to a tabular form, may therefore with advantage precede the general illustrations of the type; the terms only being so far modified as to coincide with the general system of nomenclature followed throughout this work.

(4419.)

MENTHACEÆ OR LABIATÆ.

MENTHACEÆ OR LABIATÆ.	MENTHIDÆ OR *MENTHOIDÆ*. The tube of the corolla shorter, or scarcely longer than the calyx, the limb 4-5-cleft, nearly equal, the stamens distant, extruded, with parallel or divaricate locules, rarely included, with the cells parallel.	§ 1. *Mentheæ*. Anthers 2-celled, locules parallel. § 2. *Elsholzieæ*. Anthers 2-celled, locules divaricate. § 3. *Dysophylleæ*. Anthers terminal, 1-celled, and dehiscent transversely.
	SATURIDÆ OR *SATUREINEÆ*. The tube of the corolla nearly equal to that of the calyx, bilabiate, the lips nearly equal, the upper erect and almost flat. The stamens 4 and distant, the anthers 2-celled, parallel, seldom divaricate.	§ 1. *Thymeæ*. Anthers with parallel locules. § 2. *Hyssopeæ*. Anthers with divaricate locules. § 3. *Westringieæ*. Anthers dimidiate or void.
	AJUGIDÆ OR *AJUGOIDEÆ*. The upper lip of the corolla abridged, or bifid and depressed, the lower longer and patent, the stamina ascending and much extruded.	
	MONARDIDÆ OR *MONARDEÆ*. Corolla nearly equally bilabiate, the two stamens arising from the lower lip ascending and extruded beyond the upper, or nearly equal to it. The anthers connected at the margin, the stamens of the upper lip abortive or rarely fertile, nearly included within the tube, and their anthers free.	
	NEPETIDÆ OR *NEPETEÆ*. Corolla bilabiate, stamina ascending and shorter than the upper lip. Anthers free. Akenia dry.	§ 1. *Nepeteæ*. Calyx equal or oblique, 5-10 toothed, not 2-lipped. * Stamina extruded from the tube, anthers perfect. ** Ditto, anthers dimidiate or empty. *** Stamina included within the tube. § 2. *Melisseæ*. Calyx 2-lipped, anthers 2-celled or dimidiate, with a short connectivum. § 3. *Salvieæ*. Calyx 2-lipped, anthers dimidiate, with a long filiform connectivum.
	PRASIDÆ OR *PRASIEÆ*. Corolla 2-lipped, stamina ascending. Akenia fleshy.	
	OCYMIDÆ OR *OCYMOIDEÆ*. Corolla bilabiate, stamina declinate.	

(4420.) *Menthidæ.* The mints are highly aromatic and but slightly bitter. Hence they are powerful carminatives; and several, as the pepper-mint, (*M. piperita*); the spear-mint, (*M. viridis*); the pennyroyal, (*M. Pulegium*); and various other species, such as *M. arvensis, hirsuta, rotundifolia, rubra, sylvestris,* &c. are employed as stomachics and emmenagogues. *M. viridis* is also used for culinary purposes; and from *M. citrata* a sweet-smelling oil is procured, having very much the odor of bergamot. *M. ocymoides* has been used in Pondicherry as a febrifuge, and *M. auriculata* has been recommended as a stimulating application in the treatment of deafness. Mints, although abundant in temperate regions, are very rarely met with in hot countries.

(4421.) *Lycopus Europeus* (the old Lancea Christi,) has from immemorial ages been reputed to be a powerful febrifuge. It has also been commended as an astringent, and used formerly to be administered to restrain internal hæmorrhages. It is known to make a good black dye, and Withering says that gipsies stain their skins with it.

(4422.) *Saturidæ.* The different species of thyme, as *Thymus Serpyllum, vulgaris, Nepeta, Calamintha,* &c. as well as the *marjorams, Origanum Majorana,* and *Creticum,* are all fragrant stimulating plants. The thymes in their ordinary condition are more used in cookery than in medicine; but their essential oils, as well as that of the *marjorams,* are administered to remove flatulence; and, when applied to carious teeth, to relieve toothach. When excitement was mistaken for strength, the thymes were considered as powerful tonics, whence their generic name, from θυμος.

(4423.) *Hyssopus officinalis,* our common hyssop, is, like its allies, a stimulating stomachic; and seems to be serviceable, like them, in hysterical complaints, and in relieving flatulence. There is no reason for believing the hyssopus of the moderns to be the plant called *Ezob* by the Jews, and which word our translators have rendered *Hyssop.* [Vide § 784.]

(4424.) *Ajugidæ.* *Ajuga reptans* is one of the least fragrant of the *Menthaceæ;* it is likewise all but tasteless, a slight astringency being the only ostensible property it possesses; and yet it was once extolled as a remedy in pulmonary consumption, and highly esteemed as a vulnerary. Its fame, it is probable, arose from its doing no harm; and when surgeons were fond of labouring to do great things, those injuries would doubtless be recovered from the soonest which were least interfered with, on the same principle that, by Sir Kenelm Digby, the plasters then in vogue were recommended to be applied to the weapons rather than to the wounds.

(4425.) *Teucrium Marum* is very bitter as well as fragrant: from the passion which cats have for this herb, rolling themselves over it in extacies, it has been called cat-thyme; its odor seems to act as an aphrodisiac on them.

T. Scorodonia and *Scordium* have both the smell of garlic, and hence their specific names, which are but slightly different versions of σκοροδον. When eaten by cows they communicate a flavor of onions to their milk; but few animals, save sheep and goats, feed on the germanders voluntarily. The latter was once esteemed as a vermifuge, and the former is used in Jersey as a substitute for hops in brewing, and the beer is said to become fine sooner than when made with hops; but, according to Withering, it gives too much color to the liquor.

(4426.) *T. Chamædrys* and *T. Chamæpitys* are the ground-oak and the

ground-pine of the older herbalists, so called from the shape of their leaves. Both these plants were once considered to possess anti-arthritic virtues, and the latter, in a vinous infusion, is reported to have cured Charles V. of the gout, at least, he got better after he had taken the medicine for sixty successive days. This, as a rare example of patience and of implicit obedience to medical authority, deserves to be recorded. The ground pines, as well as some other species of germander, contain a little tannin.

(4427.) *Monardidæ.* *Monarda coccinea* or *didyma*, is the *Oswego* or *Pensylvanian tea;* its leaves are fragrant, and form in infusion a very agreeable drink. *M. fistulosa* is decidedly bitter as well as aromatic, and has been used in the United States as a febrifuge. *M. punctata*, which abounds with camphor, has been employed successfully as an antispasmodic, and to relieve the nausea and sickness which attend the bilious fevers of America.

(4428.) *Rosmarinus officinalis*, the common rosemary, is a well known aromatic plant, which gives its fragrance to Hungary-water; it is likewise one of the ingredients employed in the manufacture of eau de Cologne, and it enters into the composition of the '*four-thieves' vinegar*,' once so famed for its supposed power of preventing the spread of contagious diseases. Rosemary has some reputation as a cephalic medicine; relieving headach, and exciting the mind to vigorous action. Hence it has been called the herb of memory and repentance. Thus Shakespeare says, "There's rosemary; that's for remembrance." Hence also its use as a symbol of fidelity, and its introduction both into wedding garlands and funeral wreaths; and still, in many of our distant provinces, it is customary with the mourners to put sprigs of rosemary on a corpse, and to strew the coffin and the grave with branches of the plant.

(4429.) *Nepetidæ.* This subtype contains a larger number of genera than either of the others, and, as they vary considerably in structure, they are distributed into several districts and subdistricts.

(4430.) *Nepeteæ.* The most important genera here associated are *Betonica*, *Stachys*, *Nepeta*, *Glechoma*, *Galeobdolon*, and *Galeopsis*, in the first subdistrict: *Stemigenia*, in the second: and *Marrubium* and *Lavandula* in the third.

(4431.) *Nepeta Cataria*, like *Marum*, is a feline aphrodisiac; but it is remarkable that cats do not become influenced by it unless the leaves or stems are broken: thus, as Ray observes, while growing, cats pass it by untouched; but if, by transplanting, it becomes bruised, they quickly uproot and destroy it. Hence arose the old English proverb expressed in the doggrel lines: "If you set it cats will eat it, but if you sow it, the cats won't know it." It has been used medicinally as a stimulant and antihysteric. *N. citriodora*, which to human nostrils has a much more agreeable smell, is also said to be useful in amenorrhœa; and the leaves of *N. Malabarica*, which are bitter and astringent, are taken in India to assist digestion, and to impart tone to the stomach, which in those hot climates becomes much reduced in power. *Commerçon* also tells us that in Madagascar the tuberculous roots of *N. Madagascariensis* are eaten, under the name of *Houmines*.

(4432.) *Betonica officinalis*, the betony, has little smell, but its taste is more acrid than any of the other Menthaceæ. It once enjoyed a very high reputation, especially among the Italians, as would appear from two proverbs still extant, which are all that remains of its former celebrity: the one bids a man "sell his

coat, and buy betony;" and the other, which became a common form of salutation or blessing, says, "May you have as many virtues as betony!"

In modern times, notwithstanding these ancient praises, betony is little valued; its powder has been employed as a sternutatory, and an infusion of its leaves was once recommended as a substitute for tea.

(4433.) The genus *Lamium* includes the dead, blind, and dumb nettles, of our peasants, so called from the resemblance of their leaves to the *Urticæ* in all save their stings; hence even Dodoneus called his *Lamium* primum or album, *Urtica iners.* These plants have a heavy unpleasant odor, and are not fed upon by any cattle; and yet Linneus says that in Sweden the young spring leaves are eaten by poor people as a potherb.

(4434.) Several species of *Phlomis*, or Jerusalem sage, have been used medicinally as stimulants and astringents; such as *P. Lychnitis, salviæfolia, nepetifolia*, &c. *P.* (now *Leucas) Zeylanica* is the *herba admirationis* of Rumphius, so called from the miraculous curative powers attributed to it in Ceylon, and the esteem in which it is held in India. *P. tuberosa* has fleshy tuberous roots, which, on account of their form, are applied by the Siberian serfs to reduce glandular tumors. Their most important use is, however, as food; the Kalmucs on the borders of the Caspian eat them when powdered. By them the plant is called *Bedmon. Leonurus cardiaca*, which is a stimulant, has been extolled by the Russians as a preservative against canine madness.

(4435.) *Ballota fetida*, of which there are two varieties, *alba* and *nigra*, is chiefly remarkable for its heavy offensive odor. The Stachydes are also strong-smelling plants; and some of them, as the clown's all-heal, *S. palustris*, were once esteemed as vulneraries; the tender shoots of this latter plant, when blanched, form a good esculent vegetable, something similar to asparagus in flavor. *Geleobdolon luteum* is a slight astringent, and is said also to act as a diuretic. *Galeopsis grandiflora* is commended as an expectorant, and is thought to have proved useful in phthisical complaints. *Glechoma hederacea* (the ground-ivy,) was also once much esteemed, and administered in pectoral diseases. Ground-ivy tea is still sometimes taken as an article of diet, and occasionally as a medicine; and cases are on record in which it would appear to have been really serviceable in hypochondriacal constitutions, and in monomania.

(4436.) *Marrubium vulgare* and *album* are the common and white horehounds. They are both bitter and aromatic plants, and have been recommended in chlorosis and hysteria as stimulating and tonic; they have also been commended in the treatment of intermittent fevers. An infusion of the leaves has been found serviceable in chronic catarrh and humoral asthma; and, made into a syrup or confection, or candied with sugar, they form a popular remedy for slight coughs, and, although not much used professionally, they appear to deserve more attention than they now receive.

(4437.) The *Lavenders* are much prized for the very grateful odor of their essential oils. The flowers and leaves of these plants have long been used as perfumes; and the ancients employed them to aromatize their baths, and to give a sweet scent to water in which they washed; hence indeed their generic name, *Lavandula*. The oil of *Lavandula Spica* is more pleasant than that of the other species, and is distinguished in commerce by the name of oil of spike, while the others are called oils of lavender. Sixty ounces of flowers yield only

one ounce of oil; hence its high price, and the continual adulterations of the genuine drug with oil of turpentine. According to Proust, it contains a fourth of its weight, or more, of camphor. Lavender is a grateful and powerful stimulant, and it enters into the composition of several carminative medicines; but its chief consumption is as a perfume. It is also one of the ingredients used in the preparation of eau de Cologne, and of the once famous *Vinaigre des quatre voleurs.*

(4438.) The fresh juice of the leaves of *L. carnosa* mixed with sugar-candy are said by Ainslie to be administered in India by the native practitioners, in quinsy; and *L. Stœchas* has long been employed medicinally by the Arabs, who consider it as a valuable expectorant and antispasmodic.

(4439.) Powdered lavender-leaves were once used as a cephalic snuff; and large quantities of the plant in flower are annually brought into London, where it is used by the citizens to perfume their wardrobes, and to prevent the moths from fretting their garments.

(4440.) *Melisseæ.* The balm *(Melissa)*, the bastard balm *(Melittis)*, and the calamint *(Calamintha)*, are all aromatic and slightly bitter plants. *Melissa officinalis* is sometimes taken in infusion; and balm-tea is thought by many persons to be an agreeable beverage. It is a grateful drink in fevers, but is now very little used. *Prunella* (the all-heal,) has ceased to be a vulnerary in all except its name; and the *Scutellariæ* (or skull-caps), the *Dracocephala* (or dragon's heads), and the other associated plants, are not remarkable for any very active or useful properties.

(4441.) *Salvieæ.* This district contains the sage alone, many species of which, as *S. splendens, Indica, formosa,* &c. are very ornamental flowers, and others are valued as condiments or medicines. *Salvia officinalis* is in much request in cookery, its bitterness and aroma enabling the stomach to digest fat and luscious meats. Sage-tea has also been commended as a stomachic; the Chinese are said to prefer it to their own tea, and the Dutch once carried on a profitable traffic with them, by exchanging dried sage-leaves for China tea, and getting 4 lbs. for one. *S. grandiflora* is affirmed to make better tea than the *S. officinalis.* This, as well as other species of sage, especially *S. pomifera*, are liable to be attacked by insects, the punctures of which cause the development of galls, and these morbid growths are much esteemed in Greece and Turkey as food; they are commonly met with in the markets of Crete under the name of sage-apples. The flowers of *S. glutinosa* are used in Holland to give flavor to the Rhenish wines; and a wine made by boiling the leaves and flowers of *S. Sclarea* with sugar is very pleasant, and has a taste resembling that of Frontignac. Most of the other species have similar cordial properties to the foregoing; and their former repute as health-restorers may be presumed from their generic name, *Salvia*, a derivative of *salvere—to be in good health.*

(4442.) *Prasidæ.* Of the genera *Prasium, Phyllostegia, Gomphostemma,* and their allies, included in this subtype, there are no species which are known to possess either aromatic or bitter properties in a sufficiently marked degree to render them useful in medicine, cookery, or the arts.

(4443.) *Ocimidæ.* Several *Menthaceæ*, remarkable for their aroma, have been called *Basils* (Βασιλικα), or royal spices. These are now included in the genus *Ocimum;* and, although not used in modern medicine, and seldom employed in English cookery, the basils are very fragrant stimulating plants; and on the European and Asiatic continents, *i. e.* in France, Egypt, Persia, and China,

they are much esteemed as condiments. The Chinese flavor many of their dishes with *O. gratissimum*, the taste of which, as its specific name implies, is thought to be extremely grateful. To *O. Basilicum*, *O. minimum*, and other species of basil, it is believed that French cookery is indebted for the peculiar and exquisite taste of some of its most savoury viands. *O. suave* is also fragrant, and is used in India as a stomachic, and also as a remedy for infantile catarrh. An infusion of the leaves of *O. crispum* is said by Thunberg to be administered in Japan as a cure for rheumatism. In Brazil, *O. incanescens* is esteemed as a sudorific, and *O. manosum* (?) according to Ainslie, is taken in India as a diuretic; and he adds, *O. pilosum* is there commonly used by the women to assuage the pains of childbirth; it is also eaten as an alimentary vegetable. *O. febrifugum* is the fever-wort of Sierra Leone, where it is affirmed to be most serviceable in the very severe bilious fevers which are so frequently epidemic, and so fatal to Europeans. A basil called *O. Guineense* (Sch) is likewise said to be much employed by the negroes as a febrifuge, but it is probably not specifically distinct from the preceding; and *O. sanctum* is said by Ainslie to have similar properties. *O. tenuiflorum* is esteemed as an aromatic and stimulant in Java; and in Chili, Molina informs us the *O. salinum* is greatly valued for the culinary salt it yields. The plant is indeed remarkable; for, although not growing in a saline district, and found at a great distance from the sea, it exudes daily a considerable quantity of brine, and, as the water evaporates, the stem and leaves are covered with saline particles, which are collected for domestic use. The roots of *O. tuberosum*, an Indian species at present but little known, are said to be esculent, and to form an excellent alimentary vegetable.

(4444.) *Plectranthus crassifolius* (the *O. Zatarendtii* of Forskhal) is esteemed in India both as a perfume and spice, being equally prized at the toilet and in the kitchen. The *Patchouly*, so inimical to vermin, and so efficacious in preserving clothes from being attacked by moths, is thought to be the leaves of *P. graveolens*, which have a very powerful odor; but the comminuted state in which it is imported prevents the specific identification. *P.* (now *Coleus*) *Amboinicus* is a stimulating tonic, and is said by Loureiro to be administered in Cochin-china in cases of convulsion, and even of epilepsy. *Moschosma*, and the other allies of *Ocimum*, are mostly fragrant plants, but not of sufficient economical or medical importance to require a detailed notice.

(4445.) *Ocimum*, the generic name for the basils, derived, as we are told by Matthiolus, from οζω (to smell), and having reference to the aromatic properties for which these plants are remarkable, is often confounded with the *Ocymum* of Pliny, a derivative of οκυς (quick), and which was a collective name given by the ancients to a variety of fodder-plants of rapid growth. Matthiolus, in his Commentary on Dioscorides, criticises the error which then prevailed, and which has not yet been cancelled.

(4446.) UTRICULARIACEÆ, or *Lentibularieæ*. *Pinguicula* and *Utricularia*, which together form this small type, are herbaceous, aquatic, or marshy plants, with a round stem, often abbreviated, and whorled or alternate leaves; those immersed being compound, minutely divided, radiciform, and vasculiferous, while those which are emersed are simple and verticillate.

The inflorescence is solitary and ebracteate, or sociate, and then spicate or racemose, with unibracteate pedicels; the flowers are united and irregular.

The calyx is free, herbaceous, persistent, synsepalous, bipartite, or bifid; the

lips entire, and equal or unequal, the upper being 3-toothed, while the lower is bidentate; the torus is obsolete; the corolla is hypogynous, deciduous, synpetalous, staminiferous, irregular, bilabiate (ringent or personate), the lower lip being produced at its base into a hollow spur; the stamina (2) are included within the corolla, and exserted from its base; the filaments short, and none sterile; the anthers simple, but sometimes constricted in the middle, as if sub-bilocular; the

Utricularia vulgaris.

A. Root and flowering stem.

(*a*) A flower, separated and opened.
(*b*) The pistil.
(*c*) Transverse section of the germen.
(*d*) Ripe fruit.
(*e*) Ditto, after dehiscence, to shew the seeds.
(*f*) Vertical section of a flower.
(*g*) Lower half of the capsule.
(*h*) Seed magnified.
(*i*) Vertical section of ditto.

germen is free, 1-celled, with a free, central, placentiferous column, and many ovules; the style 1, terminal, very short, persistent; the stigma bilabiate, the upper lip the smallest, and sometimes obsolete.

The fruit is a 1-celled many-seeded capsule, circumscissile or sub-indehiscent, with large free central placentæ, and many small exalbuminous seeds; the embryo sometimes being (as in *Utricularia*) undivided.

(4447.) Hence, differentially considered, the *Utriculariaceæ* are aquatic herbaceous *Menthinæ*, with irregular flowers, two fertile and no barren stamens; a 1-celled capsule, large free central placenta, and many seeds.

(4448.) *Utricularia* is physiologically interesting, from the many buoy-like vesicles that are developed on its immersed metamorphosed foliage, and which serve to float the plant. During certain seasons, the *Utriculariæ* are wholly submerged, and then the vesicles, if examined, are found full of water; but when the flowers begin to be developed, these bladders, the apertures of which are closed by a curious valve, contain only air. This is probably separated by the vital agency of the vegetable; and, during its gradual evolution, the water is expelled, and is prevented returning either by the mechanical structure of the valve, or by the constant evolution of air. Hence the whole plant is buoyed up, and gradually rises to the surface; the flowers then expand, the ovules are fertilized, and the seeds ripened; after which, the living energy of the plant flags, air no longer

is secreted in the vesicles; these again become filled with water, the whole plant sinks to the bottom, and the seeds are thus sown in their most fitting soil.

(4449.) The *Pinguiculæ* or butterworts, have been so called from the greasy appearance of their foliage. Like other marshy plants, they have been accused of occasioning the flukes in sheep that feed upon them. This is, however, attributable rather to the larvæ of the fluke, or *fascicola hepatica*, which abound in marshy districts, adhering to the leaves of the plant, and thus being conveyed into the alimentary canal, than to the immediate agency of the *Pinguiculæ*. When mixed with cow's milk, the juice of the leaves of these plants acts like common rennet; but Linneus says, that when rein-deer's milk, while warm, is poured on the leaves, and allowed to stand for a day or two, it becomes acescent, acquires consistence, and a certain degree of tenacity; neither the cream nor the serum separate; and in this form it is considered by the Swedes and Norwegians a very grateful food.

(4450.) *Utricularia* has some resemblance to *Hottonia* in habit and structure, and the type is evidently related to the *Primulaceæ* as well as to the *Scrophulariaceæ*. From the former, however, they are easily distinguished by their irregular flowers, from the latter by their central placentæ, and from both by their exalbuminous seeds.

(4451.) Scrophulariaceæ. *Scrophularia* and its typical allies are herbaceous plants (rarely shrubs), with round and knotless or square and nodose stems.

B. *Antirrhinum majus*. Cutting, to shew leaves and inflorescence.

(*a*) Corolla and stamens.

(*b*) Calyx and pistil.

(*c*) Fruit.

(*d*) Section of ditto, shewing the two cells, central placenta, and many seeds.

C. *Digitalis purpurea*. Cutting, to shew leaf and inflorescence.

(*a*) The pistil, deprived of corolla and calyx.

(*b*) Corolla and stamens.

(*c*) Calyx.

In the latter, the leaves are simple and exstipulate, petiolate or sessile, and sometimes decurrent: in situation, opposite or whorled, seldom alternate; the former when the stems are square, but when round, the latter, or, at least, the upper ones, the lower being even then occasionally opposite or crowded.

The inflorescence is variable, axillary, and sociate, usually spicate, racemose

or paniculate, seldom solitary; the bracteæ often foliose; the flowers are united and irregular, very rarely regular and symmetrical, as in *Scoparia.*

The calyx is free, persistent, synsepalous, and often 4-5 cleft; the corolla hypogynous, synpetalous, 4-5 cleft, mostly irregular, often bilabiate (ringent or personate), imbricate in æstivation, and deciduous; the disk is absent; the stamens are definite (2-4), didynamous, rarely equal, exserted from the tube of the corolla, alternate with its lower lobes, the fifth or axial stamen, and sometimes the three upper ones, being abortive; when didynamous, it is the anterior or abaxial pair that are the longest. The filaments are free, and the anthers 2-celled (rarely 1-celled), and dehiscent lengthwise by chinks; the germen is formed of two connate carpels, axial and abaxial in their position; it is 2-celled, with a central column bearing on either side placentæ, which hence are lateral, and the ovules many; the style 1, and the stigma 2-lobed, or obtuse.

The fruit is capsular and dehiscent (rarely sub-baccate and indehiscent), 2-celled, 2-4-valved, the valves entire or bifid, and the dissepiment either double, formed by the inflexed margins of the valves, or simple and entire, and then either parallel with the valves, or opposite to them. The placentæ are central, adnate with the dissepiment, or separable from it; the seeds indefinite, the embryo straight, included within the fleshy albumen, erect or inverted; the radicle in general turned towards the hilum, seldom, as in one subtype (*Rhinanthidæ*), superior, hence centrifugal in the latter, and centripetal in the former case; the cotyledons are foliaceous.

(4452.) Hence, differentially considered, the *Scrophulariaceæ* are herbaceous (seldom fruticose) *Menthinæ*, with mostly irregular un-symmetrical flowers, two accumbent carpels, forming a 2-celled superior fruit, central polyspermous placentæ, and albuminous seeds.

(4453.) The genera associated by Brown have been by several systematists divided into two orders, which are here admitted as subtypes, the principal one, from *Scrophularia,* is called the *Scrophularidæ;* and the other, from *Rhinanthus,* the *Rhinanthidæ.*

(4454.) The *Scrophularidæ* are normal *Scrophulariaceæ,* with simple bracteæ, a 2-lobed stigma, and an orthotropus embryo, the radicle being turned towards the hilum;

(4455.) While the *Rhinanthidæ* are deviating *Scrophulariaceæ,* with crested bracteæ, obtuse stigma, and an heterotropus embryo, the radicle being turned from the hilum.

(4456.) The *Scrophulariaceæ* are in general suspicious, and often deleterious plants. Several are active poisons; and others, although not absolutely venomous, are acrid, and more or less noxious; and even those which are esculent require caution in their choice, and a jealous care in their preparation: heat or vinegar appear to lessen or destroy the injurious principles when present; hence they should either be boiled or eaten as salads. The *Scrophularidæ,* which in some genera, such as *Digitalis,* &c. approach the *Solanaceæ* of the following section, are in general more active than the *Rhinanthidæ,* which in some particulars resemble the *Menthaceæ,* and are acrid rather than really poisonous.

(4457.) *Rhinanthidæ. Euphrasia, Melampyrum, Pedicularis, Rhinanthus,* and the other Scrophulariaceæ segregated to form this subtype, are bitter, and more or less acrid plants, not so much so, however, as to prevent them being fed on by domestic animals; and *Melampyrum pratense,* which is a favorite food with

kine, has hence received the common name of cow-wheat; and Linneus says, the richest and yellowest butter is made from the milk of animals grazing in pastures where it most abounds. Its generic name, *Melampyrum*, (or black wheat,) has reference to the old, and it need not be said, exploded notion that it becomes changed or metamorphosed into wheat, or that wheat degenerates into it; hence it is sometimes called the 'mother of wheat;' this absurd idea having probably no other foundation than the abundance in which it is occasionally met with in corn-fields. It has, however, a much better right to the first member of its compound name than to the last, for, like most of the plants contained in this type, it turns from a brilliant green to a dingy black, while drying.

(4458.) The bright and sparkling *Euphrasy* well deserves its name, an abbreviation of *Euphrosine;* as well as its English synonyme, eye-bright. *Euphrasia officinalis* is slightly bitter and aromatic, thus resembling the *Menthaceous labiatæ* in properties, and it used formerly to be esteemed as a remedy in certain ophthalmic disorders. The Scotch Highlanders make a collyrium of some repute by steeping it in milk.

(4459.) The *Pedicularides* are somewhat acrid plants, yet they are fed on by sheep and goats. They afford, however, but poor fodder, and are thought to render the flocks unhealthy, and to favor the breeding of vermin; hence their name, both in Latin and English, *Louseworts*. Their flowers are often pretty; and *P. sceptrum Carolinum* is really handsome. It was named by Rudbeck in honour of Charles XII., and abounds in the north of Sweden and Lapland. They have been used as vulneraries; and once, perhaps from their stimulating acridity, they were thought serviceable in the treatment of fistulæ. The leaves of *P. lanata* (Pallas) are said by Ainslie to be used in the Kurele islands as a substitute for tea. (*Mat. Ind.* i. 436.)

(4460.) *Scrophularidæ.* In absolute properties this subtype resembles in many cases the preceding; but, in the relative proportions in which the bitter and acrid principles are developed, they widely differ. In some instances also, especially in those plants which verge towards the *Solanaceæ,* certain peculiar and very active substances are superadded, which approach them, in properties as well as in structure, to the following section.

(4461.) *Mimulus luteus* and *guttatus* are examples of esculent *Scrophularidæ,* the former being eaten as a potherb in Peru, and the latter esteemed as a salad. *Mimulus moschatus* is a favorite in our gardens on account of its musk-like odor; and *M. rivularis* is physiologically interesting for the very marked degree of irritability of its stigma, the lower lip of which, when artificially irritated, or touched by a grain of pollen, curls upwards, and closes the access to the cellular channel of the style.

(4462.) *Achimenes* (olim *Diceros*) *Cochin-chinensis* forms a wholesome palatable food, and in the country where it grows it is much esteemed when pickled. The *Veronicæ* likewise are innocuous plants, and from the former use of several species, such as the brook-lime, &c. in medicine, it might be supposed that they were believed to have "as many virtues as betony," (of which their generic name is said to be a sad corruption,)—and perhaps they have as many virtues *as betony,* but no more. *V. officinalis* has been recommended as a substitute for tea, and in Sweden and Germany it was once extensively used. Martyn says, it forms a more astringent and less grateful beverage; and Withering observes, that an infusion of the leaves of *V. Chamædrys* forms a much preferable drink.

(4463.) *Scoparia dulcis*, the sweet-broom, is, according to Humboldt, used by the Indians in Spanish America as a febrifuge; and in Jamaica its twigs are made into besoms. The juice of the leaves of *Torena Asiatica* is said by Ainslie to be employed on the Malabar Coast to restrain morbid discharges from certain mucous membranes. Some of the *Calceolariæ* are reported to possess tonic and febrifuge properties, and others to be purgative and emetic. The leaves of *C. pinnata* are said to be in the latter class, and those of *C. trifida* in the former. *C. serrata* has been used as a vulnerary.

(4464.) *Antirrhinum majus*, the great snap-dragon, is bitter and slightly stimulant; and, as well as *A. Orontium* and *spurium*, has been used as a cataplasm to indolent tumors. Gmelin says, that in Persia an excellent oil, equal to that of the olive, is procured by expression of the seeds of *A. majus;* and Vogel observes, that the common people in many countries attribute some supernatural influence to this plant, believing it to have the power of destroying charms, and rendering maledictions of none effect. In Cochin-china pigs are fed on the leaves of *A. porcinum.*

(4465.) *Linaria Cymbellaria*, the ivy-leaved toad-flax, has a warm cress or caper-like flavor, and has been recommended as an antiscorbutic. Hamilton says that in India it is given mixed with sugar in cases of diabetes, and in the reports which have been made of its influence on that terrible disorder, it well deserves to be tried by European practitioners. It is a very ornamental plant for covering walls and rock-work.

(4466.) *Linaria vulgaris* and *L. Elatine* are reputed to be possessed of purgative properties. They are both bitter; and the former, which has a nauseous smell, is said to be a powerful diuretic also; and hence, in old works, it is sometimes mentioned under the name of *Urinalis.* Its flowers have been recommended in decoction as a wash for chronic diseases of the skin; and that it would not be an inactive lotion seems probable, from the fact, that in Sweden the plant is occasionally boiled in milk for the purpose of destroying flies.

(4467.) *L. vulgaris* is remarkable for a curious distortion that occasionally takes place in the development of its flowers. The monstrosity is certainly surprising, and, before the metamorphoses of plants were studied, and in some measure understood, it excited so much wonder, that Linneus called it *Peloria.*

(4468.) The *Scrophulariæ* received their generic name from the resemblance the tumid roots of some of the species bear to scrofulous swellings, and to which they were applied as poultices, the doctrine of signatures leading to the belief that nature thus indicated their virtues and the purposes to which they should be applied. *S. nodosa* has a bitter taste, and a heavy disagreeable smell, something like that of the elder. A decoction of its leaves is used by farmers and farriers to cure the scab in swine. Wasps are said to resort greatly to the flowers of the scrophulariæ, and goats will eat their herbage; but most other animals, such as cows, horses, sheep and swine, refuse it. That they are not very unwholesome plants, would appear, from the garrison of Rochelle, during the celebrated siege by Cardinal Richelieu, in 1628, having supported themselves in their extremity by eating the roots of *S. aquatica*, which has since then been called by the French "*herbe du siége.*"

(4469.) *Gratiola officinalis* is the hedge-hyssop; it has long been used in medicine, and so efficacious a remedy was it once esteemed, that it received the name of *Gratia Dei.* It contains a peculiar principle of a very active nature, which

some chemists have called *Gratioline*, but which others believe not to differ essentially from *Veratrin*. It is extremely bitter, and acts violently both as a purgative and emetic; hence it has some of the properties indicative of a serviceable medicine. On the authority of Dr. Perkins and Count Leiningin, *Gratiola* is affirmed to be the basis of the celebrated *Eau Médicinale;* and as *Gratioline*, if not identical with *Veratrine*, is very similar to it, the coincidence of gout medicines having at distant epochs and in different countries being made of *Gratiola*, *Veratrum*, and *Colchicum*, and each having similar effects, may be satisfactorily accounted for: although the chance which led to their selection is strange. *Gratiola* is said to have been found very serviceable in cases of hypochondriasis; and Dr. Kostrzewki reports, that the most marked benefit followed its administration to three maniacs in the hospital at Warsaw. In over-doses it is a violent poison, and, when growing among the grass, it is very injurious to cattle. Haller says that there are meadows about Yverdun which are rendered entirely useless as pasture, by the abundance in which it occurs.

(4470.) *Digitalis purpurea*, the purple foxglove, is one of our most beautiful native plants, and one of our most active indigenous medicines and insidious poisons. Its influence over the action of the heart, and its power of reducing the rate of the sanguineous circulation, would alone render it an important remedial agent; but when to the above are added its collateral effects on the kidnies and salivary glands, and its peculiar characteristic of lying as it were for a time latent, and accumulating the power of repeated doses, so that by one fell swoop the heart is in a moment palsied, and life at once extinct, it must be acknowledged that it is a most fearful as well as useful drug. Cases of such sudden deaths have occurred, not merely during the continued administration of the medicine, but even two or three days after it had ceased to be taken. (Vide Med. Bot. xviii., and Med. Quart. Rev. II. 454.)

(4471.) Other species of *Digitalis*, such as *D. lutea*, *ferruginea*, and *grandiflora*, are said to have' properties similar to those of the *purpurea*, but in a less marked degree, and the white-flowered variety of the officinal species is thought to be less active than the ordinary purple one. The medicinal properties and peculiar influence of foxglove on the human constitution were unknown until a very recent period; for, although it had been admitted into our Pharmacopœias, it had been discarded from them; and although, like many inactive useless herbs, it had been said by the Italian herbalists to be a sovereign remedy for all diseases, little or nothing was really known of its properties and powers until the time of Withering, whose essay on the subject brought it into note, and established its reputation. This is not the only plant, valuable as a medicine, which that meritorious botanist introduced into practice; and if it be the lot of an individual to discover one, and such a one, amongst our native weeds, it would encourage the belief that there still may be many more "blest secrets," more yet "unpublished virtues of the earth," hereafter to be revealed, as "aidant and remediate to the sick man's distress." And which, if we cannot hope they will "spring with our tears," we may more than hope they will be found by our exertions.

SOLANINÆ.

(4472.) Several types of the *Primulose Syringales* differing much in properties, but agreeing in certain general characters, are associated to form this section,

which Bartling called, collectively, the *Tubifloræ*, but which, in accordance with the principles of nomenclature hitherto followed, is here named, from *Solanum*, one of the most important and best known genera, including the potato and the nightshade, the *Solaninæ*.

A. *Convolvulus* (*Ipomæa*) *Jalapa*. Cutting, to shew the voluble stem, alternate leaves, and axillary flowers. (*a*) Part of the staminiferous corolla, with the 5 stamens. (*b*) Pistil. (*c*) Fruit in a young state. (*d*) Transverse section of the capsule. (*e*) Section of a seed magnified, to shew the embryo. (*f*) The curved embryo isolated.

B. *Solanum Dulcamara*. Cutting, to shew leaves, flowers, and fruit. (*a*) A flower separated. (*b*) The subsyngenesious anthers. (*c*) The fruit.

C. *Pulmonaria officinalis*. Entire plant, shewing leaves, flowers, &c. (*a*) The calyx. (*b*) The corolla laid open, to shew the stamens. (*c*) The fruit (a *Tetrakenium*), with central basal style. (*d*) One of the akenia separated. (*e*) A seed.

(4473.) Collectively considered, the *Solaninæ* are dichlamydeous, synpetalous, hyporollous *Rosares* or PRIMULOSÆ, with symmetrical regular (seldom irregular) flowers, the corolla 5-lobed, and often plicate (sometimes imbricate) in æstivation, the ovaria 2-4, distinct or connate, central placentæ, and in general alternate leaves.

(4474.) Five types or natural associations of genera are included in this section, and these, from *Solanum*, *Polemonium*, *Convolvulus*, *Hydrolea*, and *Borago*, are called the *Solanaceæ*, *Polemoniaceæ*, *Convolvulaceæ*, *Hydroleaceæ*, and *Boraginaceæ*.

(4475.) SOLANACEÆ. *Solanum*, and its typical associates, are herbs or shrubs, rarely arborescent plants, with aqueous juices, round or irregularly angled,

not nodoso-articulated stems and branches, sometimes armed with thorns or prickles; their leaves are alternate, simple, entire or lobed, or even pinnatisected, the floral ones occasionally double, and approximated to each other.

The inflorescence is variable, mostly axillary, sometimes extra-axillary or terminal, the pedicels ebracteate, and the flowers regular, and in general united.

The calyx is free, herbaceous, persistent, rarely circumscissile, with a deciduous limb (as in *Datura*), synpetalous, 5- (rarely 3-4) parted, and the segments equal or but slightly unequal. The corolla is hypogynous, deciduous, synpetalous, and staminiferous, with a 5-, rarely 4 cleft limb, the lobes equal (very seldom unequal) and alternate in their exsertion to the lobes of the calyx, and mostly plicate in æstivation. The stamina are epipetalous, definite, equal in number to the lobes of the corolla and alternate with them, hence 5, rarely reduced to 4, by the

A. *Atropa Belladonna.* Cutting, to shew alternate leaves, axillary inflorescence, flowers, and fruit. (*a*) Corolla laid open, to shew the stamens. (*b*) The pistil. (*d*) The fruit.

B. *Datura Stramonium.* Cutting, with leaves, flower, and young fruit. (*a*) Corolla bearing the stamens. (*b*) Pistil. (*c*) Transverse section of the fruit. (*d*) A seed.

C. *Verbascum Thapsus.* (*a*) Staminiferous corolla laid open. (*b*) Calyx with the pistil. (*c*) Young fruit without the calyx. (*d*) Transverse section of the capsule. (*e*) A seed.

abortion of the upper or adaxial one. The filaments are free, very rarely connate, none sterile, mostly equal, sometimes unequal, the lower ones being the longest. The anthers are innate, erect or incumbent, 2-celled, with apposite parallel locules, dehiscent lengthwise by chinks, rarely by apicial pores. The germen is formed of two incumbent carpels, *i. e.* adaxial and abaxial in their position,

2-celled, sometimes falsely 4-celled (as in *Datura*), or many-celled (as in *Nicotiana multivalvis*), and many-ovuled. The style 1 and continuous, and the stigma entire or 2-lobed.

The fruit is capsular or baccate, 2-valved and 2-celled, (rarely many-valved and sub-quadrilocular, or many-celled,) when capsular, with a double dissepiment parallel to the valves, when baccate, with the placentæ adhering to the dissepiments. The seeds are indefinite, sessile, and exarillate. The albumen fleshy, the embryo included, often excentrical, more or less curved, (seldom straight,) the radicle turned towards the hilum, and the cotyledons entire, and cylindrical or foliaceous.

(4476.) Hence, selecting the chief differential characters, the *Solanaceæ* are accumbent *Primulosæ*, with mostly regular plicate corollæ and central placentæ, *i. e. Solaninæ*, with a 2-celled baccate or capsular fruit, indefinite ovules, a curved embryo, and alternate leaves.

(4477.) The extent and the subordinate distribution of this type are far from being settled. *Verbascum*, which has irregular flowers, *Nolana*, which has a deeply lobed ovarium, and *Cestrum*, in which the embryo, if curved, is so slightly bent as to be more properly described as straight, have been by some botanists excluded from the *Solanaceæ*, and made the types of separate orders. Here, however, as in numerous similar cases, an intermediate course is chosen; and, without dissociating these really similar groups, they are distinguished from each other by being admitted as subtypes of a more general series.

(4478.) Hence *Verbascum*, *Celsia*, and *Anthocercis*, in which the corolla is not plaited in æstivation, and sometimes irregular, the stamens 5 and unequal, or even didynamous, and the embryo slightly curved, form the subtype *Verbascidæ*.

(4479.) In the aberrant genus, *Nolana*, which gives name to the subtype *Nolanidæ*, the corolla is regular and plaited in æstivation, the stamens equal to the petals in number, the ovarium deeply lobed, the fruit drupaceous, and the embryo arcuate.

(4480.) In the *Solanidæ* the corolla is usually plicate in æstivation, the stamens equal in number to its lobes, the fruit capsular or baccate, and the embryo much curved;

(4481.) While *Cestrum*, in which the embryo is straight, the corolla regular, the æstivation plicate, and the cotyledons foliaceous, is the normal genus of the proposed subtype *Cestridæ*.

(4482.) The *Solanaceæ* form an interesting study, from the diversity of properties prevailing in the same natural group, and their very great apparent discrepancy. The discord is however apparent only, and it requires but little consideration to reconcile the seeming inconsistences; for, notwithstanding the deadly nightshade and the esculent potato, the acrid capsicum and the bland tomato, the wholesome egg-plant and the poisonous tobacco, with the stramonium, the henbane, the mandragora, and various other equally deleterious or equally innocuous plants, are found associated in the same natural order, they all afford evidence in favor of the doctrine of homomorphism, instead of being, as they at first appear, exceptions to the general rule—that plants having similar structures have similar properties likewise. The deleterious principles prevalent in the *Solanaceæ* are narcotics of a peculiar kind, and exercising a very singular and characteristic influence, especially over the pupil. Several of these principles

have been separated, and from the plants in which they are found (not exclusively yet) in the greatest relative proportions, they have been called *Atropine, Solanine, Daturine, Hyoscyamine*, &c.

(4483.) Experiments shew that even in the plants where these principles, which, when concentrated, are so noxious, the most abound, they seldom, if ever, occur in equal proportions in all parts; the root, the stem, the leaves, the fruit, or the seeds, are in turn its especial seat; while it is found less concentrated in the other parts, and occasionally from some altogether absent; or in such a condition or degree as to be easily dissipated by heat, or separable by other means. Instances of this kind have already been several times adverted to, such as the presence of opium in the seed-vessel, and its absence from the seeds of the poppy, the prevalence of prussic acid in the leaves, and not in the sarcocarp of the Lauro-cerasi; in the spermoderm, but not in the nucleus of the bitter-almond; as well as the further instances of the production of the bland-nutritious Cassava, known to us as tapioca, the sick man's food, from the roots of the manihot, which in a raw state are deadly poisons.

(4484.) Now that which occurs thus notably in individual plants occurs still more remarkably in varieties, even of the same species, subjected to different external influences, and yet more decidedly in different species and genera of one natural group. Thus the same narcotic principle which is so deadly a poison when developed to excess in the *Mandragora, Belladonna*, and the *Nightshade*, is present in the potato, the tomato, and the egg-plant; but it is present in the latter in such small relative proportion to the inert or nutritious substances with which it is blended, as to be altogether innocuous, and not to prevent them being employed as food. In the common potato the narcotic principle is present in too large a proportion in the stems and leaves, and other parts exposed to light, to allow them to be used as human food; but the underground tubers, where exclusion from the light prevents its full elaboration, and where the vast deposits of fecula neutralize its effects, we find to be wholesome and nutritious. Furthermore, it must not be forgotten, that in all cases where we derive food from poisonous plants or suspected tribes, they are, as in the case of the tomato, the egg-plant, the potato, and the cassava, subjected to the action of fire before they are eaten, or, as is the case with the capsicum, taken in such small quantities as to be rather considered spices than food. De Candolle, when discoursing on this subject, observes, with his usual acuteness and discrimination, "it is a fact which should never be lost sight of, that all our aliments contain a small proportion of an exciting principle, which, should it occur in a much greater quantity, might become injurious, but which is necessary as a natural condiment," and that, when this stimulating principle is naturally in very small proportion, we increase it by art, or supply its place by the addition of spice.

(4485.) Bearing these data in mind, Fee has proposed a classification of the *Solanaceæ*, according to the purposes to which they are applicable, these being dependant upon the relative proportions in which their active and inert principles are developed, so as to render them, on the one hand, esculent, and on the other, poisonous, which extremes may be connected by an intermediate series, the genera of which contain both poisonous and wholesome species.

(4486.) Thus, in his first group, which comprehends those genera all the species of which are dangerous or suspected plants, may be enumerated *Atropa*,

Mandragora, Hyoscyamus, Datura, Nicotiana, Solandra, Physalis, Nicandra, and *Cestrum.*

(4487.) To his second group, which contains those genera some of the species of which are poisonous and some innocuous, belong *Solanum* and *Capsicum;*

(4488.) While of his third, including those genera all the species of which are innocent, *Lycopersicon, Celsia, Crescentia,* and *Verbascum,* are given as examples.

(4489.) *Verbascidæ.* This subtype, which is evidently transitional from the preceding section to the present, shews its affinity to the *Scrophulariaceæ,* in which both *Verbascum* and *Anthocercis* are by some botanists associated, by the irregular corolla of the former, and the didynamous stamina both of *Celsia* and *Anthocercis;* but their curved embryo and alternate leaves, perhaps, are characters of greater value, and locate them rather with the *Solanaceæ;* but the decision is not unquestionable. [§ 4475, c.]

(4490.) The *Verbasca* are shewy, and often handsome herbaceous plants, their leaves and stems covered with a thick beard or down, whence their name, which is said to be a corruption of *Barbascum.* This downy matter forms a thick woolly coat on the leaves of *V. Lychnitis,* the cuticle of which has been used as a substitute for tinder, and to make wicks for lamps, as referred to in its specific appellation. Morin says it contains a colouring matter, which has been employed for the purpose of dying cotton goods of a durable yellow, and tells us that an infusion of its flowers was formerly used by the Roman ladies to tinge their tresses of that reddish hue once so much admired in Italy. *V. Blattaria* is peculiarly offensive to cockroaches, and therefore, strewing its leaves about, is one of the means resorted to, to get rid of those troublesome insects. *V. nigrum,* the common mullien, is said to be slightly narcotic, and to be one of the plants used by poachers to intoxicate and capture fish.

(4491.) *Nolanidæ.* *Nolana,* by its usually deeply lobed ovarium, and especially by the fruit in one of the species, *N. paradoxa,* consisting of crowded drupeolæ, is a very aberrant genus. It appears to be equally related to the tetrakenious and subdrupaceous *Menthaceæ* on the one hand, and to the *Convolvulaceæ* on the other; although its arcuate embryo and plaited corolla decide its strongest affinity to be with the solanaceous group.

(4492.) *N. prostrata,* which is a native of Peru, grows freely in this country in the open air. In France poultry are fed on it, and they are so fond of the plant, that Persoon proposed to call it *N. gallinacea.*

(4493.) *Solanidæ.* This subtype has been separated into two districts, the one called *Solaneæ,* containing the baccate genera, and the other *Datureæ,* in which will be found those with capsular fruits.

(4494.) *Datureæ.* The henbane, the tobacco, and the thorn-apple, with their offsets, *Scopolia* and *Brugmansia,* are the most important examples of this district.

(4495.) *Hyoscyamus niger* is the common henbane. It is a powerful narcotic, and, when taken in any considerable quantity, proves quickly poisonous to men and most brute animals; swine are said to be able to feed on it with impunity, hence indeed its generic name; and goats and sheep will eat it, though sparingly, but no other animals, save two insects, a species of *Cimex* or bug, and *Chrysomela* or beetle, are known to resort to it as food.

The leaves are the parts usually employed in medicine, but the seeds are also

said to have similar narcotic properties. In the seeds, however, the soporific powers, if present, are most probably in a reduced degree, as Smith and Martyn state that they have eaten them without inconvenience: it must nevertheless be remembered, by those who desire to institute further experiments, that Lightfoot affirms, a few of them have deprived a man of his reason and of the use of his limbs. Pallas tells us that the seeds of *H. Physalöides,* when roasted and infused, make an excellent substitute for coffee; and Forskal says that in Arabia those of *H. Datora* are applied to a similar purpose, but he adds, the beverage thus prepared is valued by the Orientals chiefly for its intoxicating powers; so, whether these analogies confirm the account of Smith and Martyn respecting the allied species (*niger*), or whether the noxious principle, if present, may be dissipated in the one instance, and lessened in the other, by torrefaction, remains to be proved.

(4496.) In the south of Europe *H. albus* is used officinally instead of *H. niger,* merely because it is more common. The two species seem to differ very little, if at all, in their properties. The leaves are sometimes smoked to relieve toothach.

(4497.) One of the most powerful narcotics, and one of the most important plants in this group, in a commercial point of view, is the tobacco. There are about thirty species of *Nicotiana,* and some of these are natives, or naturalized in most parts of the world; for, although its use was unknown in Europe before the discovery of America, indulgence in its fumes is so common, nay, so universal among the Chinese, and the forms of their bamboo pipes and their methods of inhaling so peculiar, that Pallas and many others have been led to believe that the custom is aboriginal with them, and that they and other nations of the East were acquainted with its use before the discovery of the Western hemisphere. Two or more species, *N. Sinensis* and *N. fruticosa,* are also believed to be natives of China, and *N. Nepalensis* of Hindustan. Chardin states that its use was common in Persia long before the discovery of America, and that it is a native of that country, or at least was naturalized there as early as 1260. Furthermore, Liebault asserts that one species (his "petit tabac sauvage,") is a native of Europe, and that it was found wild in the forest of Ardennes previous to the discovery of the New World: this assertion seems, however, to be deficient in proof, and its correctness is doubted by most naturalists.

(4498.) All the species of *Nicotiana* possess the same, or nearly similar properties; but two only, *N. Tabacum* and *N. rustica,* are in much repute, or are much cultivated for use. The specific name, *Tabacum,* is not, as was long supposed, a slight corruption of *Tobago* or *Tobasco,* whence the drug is brought, but is, as Humboldt has shewn, the Haytian word for the pipe in which it is smoked, and which has been transferred, like the term *Mate* [§ 1928], from the instrument to the herb.

(4499.) The history of tobacco is one of peculiar interest. It was first introduced into Europe about 1560, seeds being sent by Jean Nicot, from whom it derives its generic name, to Catherine de Medici; but it was not until 1586 that the use of the herb became generally known, and the practice of smoking introduced into England by Sir Walter Raleigh, and the settlers who returned from Virginia. Hariott, who accompanied the expedition which was sent out to attempt to found a colony in Virginia, gives, along with a description of the tobacco-

plant, an account of the manner in which it was used by the native Americans; and adds, that the English, during the time of their stay abroad, and since their return home, were accustomed to smoke it after the fashion of the Indians, "and found many rare and wonderful experiments of the virtue thereof."

(4500.) Like coffee and Peruvian bark, tobacco encountered much violent opposition, when its half-inebriating and soothing influence recommended it to popular use. Many governments attempted to restrain its consumption by penal edicts. The sultan Amurath IV. forbade its importation into Turkey, and condemned to death those found guilty of smoking, from a fear that it produced barrenness. The Grand Duke of Moscow prohibited its entrance into his dominions, under pain of the knout for the first offence, and death for the next; and in other parts of Russia the practice of smoking was denounced, and all smokers condemned to have their noses cut off. The Shah of Persia, and other sovereigns, were equally severe in their enactments; and Pope Urban VIII. anathematized all those who smoked in churches. In 1654 the council of one of the Swiss cantons cited all smokers before them; every innkeeper was ordered to inform against those who were found smoking in their houses: and in the laws of Bern there is conclusive evidence of the serious light in which this at that time presumed crime was held, for the prohibition of smoking immediately follows the enactments against adultery. But not only legislators, but philosophers, or at least, book-makers, entered into a crusade against tobacco. Upwards of a hundred volumes, the names of which have been preserved and the titles catalogued, were written to condemn its use; and amongst these, not the least singular was the "Counterblaste" of our pedantic James. His vituperations indeed are most amusing; and, although in some parts the language is too gross for modern taste, its tenor may be judged of from the following quotations, as well as from the banquet which the same monarch proposed for the devil, viz. "a loin of pork, a poll of ling, and a *pipe of tobacco.*"

(4501.) "Tobacco," says the royal scribe, "is a common herb, which (though under divers names) grows almost every where, and was first found out by some of the barbarous Indians to be a preservative or antidote for (a certain disreputable malady,) a filthy disease, whereunto these barbarous people are (as all men know) very much subject, what through the uncleanly and adust constitution of their bodies, and what through the intemperate heat of their climate. So that as from them was first brought into Christendom that most detestable disease, so from them likewise was brought this use of tobacco, as a stinking and unsavourie antidote for so corrupted and execrable a maladie; the stinking fumigation whereof they yet use against that disease, making so one canker or venom to eate out another."

"Now to the corrupted basenesse of the first use of this tobacco doeth very well agree the foolish and groundlesse first entry thereof into this kingdome. It was neither brought in by king, great conqueror, nor learned doctour of physicke. With the reporte of a great discovery for a conqueste, some 2 or 3 savage men were brought in, together with this savage custom. But the pitie is, the poore wild barbarous men died, but that vile barbarous custom is yet alive, yea in fresh vigour."

His physiological arguments, out of respect to the monarch, may be passed over without notice; in truth, they are not worth abridgment; but his detail of the post-mortem appearances of the body of an inveterate smoker are too exqui-

site to be altogether omitted. "Surely smoke becomes a kitchen farre better than a dining chamber; and yet it makes a kitchen oftentimes in the inward parts of men, soyling and infecting them with an unctuous and oyly kind of soote, as hath been found in some great tobacco-takers that after their death were opened."

The monarch then enters into a pathetic expostulation with his loving subjects, and appeals to their patriotism, or rather national pride: "Now, my good countrymen, let us (I pray you) consider what honour or policie can move us to imitate the barbarous and beastlie manners of the wild, godlesse, and slavish Indians, especially in so vile and filthy a custome. Shall we, that disdain to imitate the manners of our neighbour *France* (having the style of the greate Christian kingdom), and that cannot endure the spirit of the Spaniards (their king being now comparable in largenesse of dominions to the greatest emperor of Turkey); shall we, I say, that have been so long civill and wealthy in peace, famous and invincible in war, fortunate in both,—we that have been ever able to aid any of our neighbours, (but never deafened any of their ears with any of our supplications for assistance;) shall we, I say, without blushing, abase ourselves so far as to imitate these beastlie *Indians*, slaves to the *Spaniards*, the refuse of the worlde, and as yet aliens from the holy covenant of God? Why do we not as well imitate them in walking naked as they do, in preferring glasses, feathers, and toys, to gold and precious stones, as they do? Yea, why do we not deny God, and adore the devils, as they do?

"Have you not then reason to forbeare this filthie noveltie, so basely grounded, so foolishly received, and so grosslie mistaken in the right use thereof? In your abuse thereof, sinning against God, harming yourselves both in persons and goods, and raking also thereby the markes and notes of vanitie upon you; by the custome thereof, making yourselves to be wondered at by all forreine civill nations; and by all strangers that come among you, to be scorned and contemned: a custome loathsome to the eye, hatefull to the nose, harmfull to the braine, dangerous to the lungs, and in the blacke stinking fume thereof nearest resembling the horrible Stigian smoke of the pit that is bottomless."

(4502.) Of the sincerity of the royal anti-tobacconist there can be no doubt, if any reliance may be placed on energy of expression, or on his almost unequalled force of language. But, notwithstanding all opposition, smoking and snuffing have spread not only through polished, but savage countries; and, instead of being "scorned and contemned by strangers," and "wondered at by all forreine civill nations," the English now are countenanced, nay, not only equalled, but exceeded, in the custom by many other people; for, during the reign of George III., the practice of smoking declined in this country, although, since the peace, it has been again in some part revived.

"In Spain, France, and Germany, in Holland, Sweden, Denmark, and Russia," says a writer in the Asiatic Journal, xxii. 142, "the practice of smoking prevails among the rich and poor, the learned and the gay. In the United States of America smoking is often carried to an extreme excess. It is not uncommon for boys to have a pipe or cigar in the mouth during the greater part of the day. The death of a child is not unfrequently recorded in American newspapers with the following remark subjoined: 'Supposed to be occasioned by excessive smoking.' If we pass to the east, we shall find the practice almost universal. In Turkey the pipe is perpetually in the mouth; and the most solemn conferences are generally con-

cluded with a friendly pipe, employed like the *calumet* of peace amongst the Indians. In the East Indies, not merely all classes, but both sexes inhale the fragrant steam; the only distinction among them consisting in the shape of the instrument employed, and the kind of herb smoked. In China the habit equally prevails. Barrow states that every Chinese female, from eight to nine years old, wears as an appendage to her dress a small silken purse or pocket to hold tobacco, and a pipe, with the use of which many of them are not unacquainted at this tender age."

(4503.) That excessive smoking is injurious, like excessive indulgence of any other kind, there is no doubt, and those who are guilty of such excess must expect to suffer for their imprudence or their folly; but that there is anything peculiarly injurious in the use of tobacco, whether "chewed, smoked, or snuffed," remains to be proved. The evidence, on the contrary, would seem to shew that it is one of the less injurious excitants and sedatives. Dr. Thompson observes, that in the snuff-manufactories of France, where 4,000 persons are employed, and where, from their constant exposure to the influence of tobacco, to a much greater extent than the consumers can be, it has been ascertained that they live as long, and are as healthy, as manufacturers in general. Such being the facts, putting all prejudice aside, and believing, from accumulated evidence, the pleasurable sensations which the slight stimulus of a pinch of snuff gives rise to, a pleasure which can be resorted to so much more often, and with so much less probability of being injurious, than any other stimulus; and, having watched the composing influence of a cigar, the contentment which springs up in the mind as the smoke rises in the air, the calmness and satisfaction it produces, and the temporary happiness of which it is the cause, it does seem, at least to one who, be it observed, neither smokes, snuffs, nor chews tobacco, not wonderful that the custom of smoking and taking snuff should prevail amongst all people. and in all countries; nor is there any sound argument to be raised against the practice: indeed, the discontinuance of that which so materially increases the sum of human happiness would be greatly to be deplored. Philippics and royal anathemas have long since ceased, and legislatorial prohibitions have been evaded or repealed; whether this may have been the result of a rational conviction of its utility, or whether the fact, of a very considerable part of the revenues of all the sovereigns of Europe, as well as of those of most other parts of the world, being derived from a duty on tobacco, may have had anything to do with the present state of toleration, it imports us not to determine, but it seems not improbable that the tone of our James's Counterblaste would have been very much subdued, had he been forewarned that, by a duty levied on tobacco, between three and four millions a year might be added to the revenue of his kingdom; and truly, when persons are content to tax themselves to such an amount for the enjoyment of a harmless luxury, he must be a tyrant indeed who would set his *veto* against the indulgence.

(4504.) Tobacco is used medicinally in powder as an errhine, in infusion as an expectorant and sedative, and in vapour, both as an antispasmodic, and to bring on nausea and fainting. *Tobacco enemata* have been found serviceable in relaxing the parts implicated in strangulated herniæ, so as to allow them to become reducible, but it is a dangerous remedy, and, from its unmanageable character, not frequently employed. Tobacco is often employed as a masticatory, but this is the least commendable mode of use. It impairs the appetite, brings on torpor of the gastric nerves, and hence, although it may at times be convenient to ap-

pease the calls of hunger without eating, when on a journey, or when food is not within reach, yet the practice of chewing tobacco, when indulged in, as it sometimes is, by the lower classes, is commonly followed by the distressing train of symptoms familiar to all as the Protean forms of dyspepsia.

(4505.) The active properties of tobacco appear to depend upon two proximate principles, which bear a considerable resemblance to each other, and which some authorities believe to be only varieties of one and the same body. These have been called *Nicotine* and *Nicotianine;* the latter, which is procured from the leaves by simple distillation, appears to be a solid volatile oil. It is poisonous, and resembles in its effects ordinary tobacco in a concentrated form. The former, when pure, is a colourless fluid, extremely acrid and pungent, and most virulently poisonous. It has been extracted both from the seeds and leaves. Besides these, there has been procured an empyreumatic oil, by destructive distillation, which probably contains both the preceding substances mixed with various impurities. This oil is formed whenever tobacco is burned; and it was first noticed, or at least first made use of, by the Hottentots, who are accustomed to poison snakes by putting a drop of it on their tongues. The effect of the application, Barrow says, is instantaneous, almost like that of an electric shock; and many experiments which have been made by Brodie and others, as well as some accidents which have occurred, prove that the oil of tobacco is one of the most active poisons known. In some peculiar constitutions, even small quantities of the powdered leaves, or their fumes, have proved injurious, or even fatal. The celebrated Santeuil is said to have experienced vomitings and horrible pains, amidst which he expired, in consequence of having drank a glass of wine into which some Spanish snuff had been put; intoxication, vomiting, faintings, and other untoward symptoms, have been known to follow the application of tobacco ointment to scald heads; and Mr. Howison gives a very interesting account of a kind of trance into which he was thrown, being conscious of all around, but unable to move or speak, from lying down to sleep among numerous packages of fresh tobacco. (Vide Med. Bot. xxxvii.)

(4506.) Tobacco might be cultivated in these islands, and is grown in larger or smaller quantities in most parts of Europe; but, for the benefit of our West Indian colonies, as well as for the more easy collection of the duty, it is forbidden by law to be cultivated here to a greater extent than half a rood. Upwards of 25 million lbs. of tobacco paying duty, besides what is smuggled, are annually imported into this country. Its value in bond varies, according to quality, from 2½*d.* to 6*d.* per lb., the duty being 3*s.* per lb., or 1440 per cent. on the inferior, and 600 per cent. on the superior kinds. These high duties tend to encourage smuggling, which is carried on with this article to an unequalled extent. One fourth of the tobacco consumed in Great Britain is, according to official estimates, believed to be smuggled; and in Ireland only one-fourth part pays duty, the other three-fourths being supplied by smugglers.

(4507.) *N. multivalvis*, like *Nolana paradoxa,* is a very aberrant plant, for its capsule consists of many valves, formed by the addition of a supernumerary whorl of carpellary leaves outside of the two central and normal ones.

(4508.) The *Thorn-apples* are different species of *Datura,* (so called from the Arabic word datora or tâtôrâh,) and some of them are natives of either hemisphere. *D. Stramonium,* the common thorn-apple, now naturalized in Britain, is a native of America, where it was so troublesome a weed on the newly cleared

ground, and produced such extraordinary effects when eaten by the new settlers, that it obtained from the European colonists the name of the Devil's apple, or the James-town weed. It is remarkable that a variety of this species, viz. *D. canescens*, is indigenous to Nepal. *D. ferox* is a native of China, *D. fastuosa* of Egypt and Arabia, *D. Metel* of Arabia and India, and *D. Tatula* of Peru. These different species have very similar properties, and have long been used both by the Americans and Asiatics as poisons. Strange tales indeed were once prevalent as to the consummate skill with which the savages prepared this drug, and the purposes to which, amongst them, it was said to be devoted. Milne, when treating on this subject, says, "Of the intoxicating quality of their native species of stramonium, the women, in some of the Asiatic islands, we are informed by travellers, so dexterously avail themselves, as not only with impunity to use the most indecent freedoms, but even to enjoy their gallants in the company of their husbands; who, being presented with a proper quantity of this soporific and Lethean drug, are at first seized with a fatuity and pleasing delirium, soon followed by those very convenient symptoms, stupor and a total want of recollection;" and, as a proof of the general credence given to the above and similar reports, the Royal Society gravely proposed the following question to Sir Philberto Vernatti, "whether the Indians can so prepare the stupifying herb datura, that they make it lie several days, months, or years, according as they will have it, in a man's body, and at the end kill him, without missing half an hour's time?"

(4509.) Beverly, in his History of Virginia, gives a very circumstantial account of the effects of stramonium. He says, "the James'-town weed, which resembles the thorny apple of Peru, (and I take to be the plant so called,) is supposed to be one of the greatest coolers in the world. This being an early plant, was gathered very young for a boiled salad by some of the soldiers sent thither to quell the rebellion of Bacon, and some of them ate plentifully of it; the effect of which was a very pleasant comedy, for they turned natural fools upon it for several days. One would blow up a feather into the air, another would dart straws at it with much fury; another, stark naked, was seen sitting up in a corner like a monkey, grinning and making mouths. A fourth would fondly kiss and paw his companions, and sneer in their faces with a countenance more antic than any in a Dutch droll. In this frantic condition they were confined, lest in their folly they should destroy themselves. A thousand simple tricks they played, but, after eleven days, returned to themselves again, not remembering any thing that had passed."

(4510.) That the stramonium is a powerful narcotic, and that the stupor it occasions is sometimes preceded by extraordinary symptoms of fatuity, there is evidence enough to prove; but great allowance must be made for the exaggerations which fear often unwittingly introduces into accounts given of things, for the first time observed; yet several reports, published in the Transactions of the Philadelphian College of Physicians, and in other authentic journals, tend to confirm some of the above accounts. Thus Dr. Barton mentions the case of a child suddenly seized with idiotcy without fever. The pulse, he says, was natural, tongue clean, and no internal function disturbed, excepting that of the brain. The boy appeared very happy, talking, laughing, and in constant motion, yet, so weak, he could not stand or walk, without tottering. An emetic was administered, some seeds of the thorn-apple which the child had swallowed were brought up, and quickly after their rejection he recovered. Gmelin also says, that beer in which

the seeds of *D. ferox* have been steeped causes delirium, which lasts for about twenty-four hours.

(4511.) *Stramonium* is an antispasmodic and excitant, as well as a narcotic; the two preceding properties appear to be more prominent in it than in many other sedatives, and hence the delirium and maniacal symptoms which characterize its exhibition. *D. ferox* has long been smoked in India in the manner of tobacco, and reputed to be a remedy for asthma; and *D. Stramonium* has been substituted for it in this country and America. Sometimes benefit has been obtained from inhaling its fumes, but more frequently it has failed to afford any substantial relief.

(4512.) *Brugmansia candida* and *suaveolens*, two species formerly confounded under the name of *Datura arborea*, possess properties very similar to those of the *Daturæ*. It is said that in Chili, where *D. suaveolens* is indigenous, a decoction of its leaves is drank by the conjurors and soothsayers of the country, before they cast lots and tell fortunes. This beverage produces a sort of intoxication, and in this condition their delirious ravings are regarded as revelations. The practice is however very dangerous, and these deluded and deluding men are sometimes reduced to extremities. Both species have very handsome flowers, but their exhalations are believed to be noxious, for birds hung in a cage near these plants have been found in a state of asphyxia.

(4513.) *Solaneæ.* The baccate *Solanidæ* are no less interesting, and perhaps, on the whole, more really important plants than the capsular ones; for here will be found the genera *Atropa*, and *Mandragora, Capsicum, Cestrum, Solanum*, and *Lycopersicon*, besides *Solandra, Crescentia, Physalis, Nicandra, Lycium*, and others.

(4514.) *Atropa Belladonna*, the *Dwale* or deadly nightshade, [the *Solanum lethale, maniacum*, or *furiosum*, of the older writers,] is one of the most powerful of our native narcotic poisons: and its various synonymes are truly expressive of its strangely fatal powers. Its present generic name is a slight variation of *Atropos*, one of the evil destinies, and a derivative of α and τρεπω, being thus indicative of the inevitable fate of such as become subject to its influence. The modern specific name refers to the use once made of its berries by the Italian ladies as a cosmetic; and the older ones, *lethale, maniacum*, and *furiosum*, allude to the frantic delirium, nay madness, which precede death when it is taken in over-doses. From the tempting appearance of its black, shining, cherry-like fruits, accidents have frequently happened to children and others who have eaten it, being ignorant of its deleterious properties.

(4515.) Koestler, of Vienna, has placed upon record the symptoms which occurred in five persons of different ages, who ate more or less freely of the berries of this fatal plant. They were a man and his two sons, one a boy nine years old, the other five years of age, and two older daughters. The younger children ate the most, and in them the phenomena were the most marked. They became restless and delirious, complained of pain in the head, giddiness, dimness of vision, and subsequently loss of sight. The pupils were much dilated, the restlessness uncontrollable, but the wanderings all on lively su jects. There were observed frequent spasmodic contractions of the muscles of the eyeballs, and of the throat, especially of the latter, whenever any attempts were made to swallow; the phenomena, on the whole, bearing a strong resemblance to the symptoms of mania.

But a still more important record is that of M. Gaultier de Claubry, who

relates the cases of 150 soldiers, who were poisoned by it near Dresden. (Sedillot's Journ.) The cases of six soldiers, likewise poisoned by this deadly plant, are given by Mr. Brumwell, (in the Lond. Med. Observations and Inquiries,) and in most of these the delirium was extravagant, and commonly of the most pleasing kind, sometimes accompanied with immoderate and uncontrollable paroxysms of laughter, sometimes with constant talking, but occasionally, as in the soldiers, with complete aphonia.

(4516.) The poisonous properties of this plant have been long known, as appears from its having been resorted to by the Scotch, under Macbeth, to poison the Danes, they having treacherously given to the troops of Sweno, during a truce, bread, and a mixture of ale and wine impregnated with a poison, which, it is evident, from the account given by Buchanan, was the Belladonna. The mania it occasions was a circumstance too extraordinary to escape the observation of Shakspeare, who, in the speech of *Banquo*, is believed to refer to it in the words, "Or have we eaten of the insane root that takes the reason prisoner?" And even in much earlier times, the paroxysms of madness which were brought on by it seem, as well indeed they might, to have challenged the wonder of observers; for it is supposed, and not without reason, to be the plant eaten by the troops of Mark Antony, when distressed for provisions, and the strange effects of which are recorded by Plutarch, in his account of the Parthian war. He says, "those who sought for herbs obtained few that they had been accustomed to eat, and in tasting unknown herbs they found one that brought on madness and death. He that had eaten of it immediately lost all memory and knowledge, but at the same time would busy himself in turning and moving every stone he met with, as if he was upon some very important pursuit. The camp was full of unhappy men, bending to the ground, and thus digging up and removing stones, till at last they were carried off by a bilious vomiting, when wine, the only remedy, was not to be found."

(4517.) Belladonna is a most powerful sedative, but its internal use does not, on the whole, seem to have proved so beneficial as its external application: spread on plaster, and applied over the region of the pylorus, or along the course of the nerves, it has been often found to afford very marked relief in scirrhus and neuralgia, and introduced in small quantities, mixed with soap, it has frequently assuaged, if not entirely suspended, the torturing pains that accompany ulceration of the vagina and neck of the uterus. Its power of dilating the pupil, when smeared over the parts around the orbit, is well known; and it was once thought that advantage might be taken of it in the treatment of ophthalmia, and in certain operations on the eye: but the hopes entertained of its use in cases of the former kind have been disappointed, although in the latter it proves sometimes serviceable.

(4518.) Belladonna has been much extolled as a remedy in hooping-cough: and from its exhibition being accompanied by symptoms resembling those of scarlatina, it has been recommended as a preventive against that disorder, and it does really seem, on experiment, to render persons insusceptible to the infection of scarlet fever.

(4519.) *Mandragora* is a genus separated from *Atropa*, and the mandrakes, like the dwales, are very poisonous plants; but they are not so frequently taken either by accident or otherwise, and are now wholly obsolete as medicines: that they were once esteemed as sedatives, and generally regarded as powerful ones, seems probable, from Shakspeare associating *poppy* and *mandragora;* but their

narcotic effects are inferior to those of *Belladonna*. The root of the mandrake is carrot-shaped and fleshy, and often forked. Fanciful persons have thought that, when thus divided, it bears some resemblance to the legs of a man; and the crafty have not failed to assist the folly of superstition by artfully increasing the similitude, and attributing to the plant thus fashioned supernatural powers. By the Greeks and Latins it was called *Anthropomorphon* and *Semi-homo*, and was in constant request as an ingredient in philtres and love-potions. A profitable trade was once carried on in this country by mountebanks, who manufactured mandrake-roots, and sold them to the multitude as incentives to love; and, although the custom is exploded here, it is still rife on the Continent; for in 1810 they were seen to be exposed for sale in several of the sea-port towns of France. Some commentators believe our mandragora to be the mandrake of Scripture, but, although the original word has been thus translated, nothing decisive is known with regard to the *Dudaim* of Rachel: nevertheless, it seems evident, whatever the plant might be which had been found by Leah's son, that properties were then attributed to it of a similar kind to those which the *Anthropomorphon* of the Greeks was reputed to possess.

(4520.) *Solanum* is a large and very important genus, containing the different species of *nightshade* and *potato*. The tomato is sometimes included also; but by modern writers it is in general distinguished as a separate genus, under the name of *Lycopersicum*.

(4521.) The *Lycopersica* are distinguished by having the calyx 5-6 parted, the corolla rotate and 5-6 lobed, the anthers connate at their apices by an elongated membrane, and dehiscent introrsely and lengthwise; the fruit 2-3 celled, and the seed villous;

(4522.) While in the *Solana* the calyx is 5-10 parted, the corolla subrotate, and 4-10 cleft. The anthers simply connivent, and dehiscent at the apex by double pores. The berry 2-3-4 celled, the placentæ adnate to the septum, and the seeds glabrous.

(4523.) *Solanum tuberosum* is the *potato*; and, although a plant of comparatively modern introduction into the Old World, being a native of Peru, and unknown until some time after the discovery of America, it is now naturalized in every quarter of the globe, and has become a necessary of life in almost every civilized community. After the corns, our staple sustenance, perhaps no one plant is of more importance as an article of food than the potato. In the neighbourhood of Quito, whence the potato was first brought into Europe, it is called papas, which word was corrupted by the Spaniards, who originally received the plant, and made into *potades*: but, although the potato was brought to Spain in the early part of the 16th century, and travelled thence to Italy, it does not seem to have been known in England until 1586, on the return of Sir Walter Raleigh from Virginia, who is believed to have been the first who brought it here. He is said to have distributed a number of tubers in Ireland, where they were planted and throve exceedingly, and that they were subsequently introduced into England from the Sister island. It is a remarkable fact in the history of this plant, that Virginia, whence potatos were first brought to Ireland, was some years afterwards saved from famine by a large supply, conveyed across the Atlantic from the very country to which they had so short a time before been sent; thus, as it were, illustrating the soundness of the doctrine contained in those beautiful words, "Cast thy bread upon the waters, and it shall return to thee after many days."

(4524.) The cultivated varieties of the potato are very numerous; but it is scarcely, if at all, found, or the least recognizable, in a wild state. That it is an American plant there is no doubt, although attempts have been made to shew that it was not unknown to the ancients; and that it is a native of Peru or Chili is highly probable, whence it was conveyed to other parts of that vast continent; but the potato of Chili mentioned by Humboldt is bitter, and scarcely eatable Culture, however, works great changes in plants; and in Quito it had been long under cultivation.

(4525.) Much prejudice at one time existed against the use of the potato as food, especially in France; and this was not improbably increased, if not wholly excited, by the circumstance of its belonging to a tribe and a genus notorious for their poisonous properties. Indeed, the leaves of the *Solanum tuberosum*, which have a smell something resembling that of tobacco, its fruit, and even its unearthed branches and tubers, are deleterious; and the water in which the esculent tubers are boiled is said to be unwholesome. The potato is generally eaten simply boiled or roasted, but the tubers have been reduced to the state of flour, and made into bread and different kinds of pastry. Potato starch and potato arrow-root are also manufactured, and by torrefaction this starch is convertible into gum. By the addition of sulphuric acid to potato-flour a large quantity of saccharine matter is procured, and this, by fermentation, can be made into an intoxicating liquor, from which potato-brandy is distilled. The potato is likewise remarkable for becoming phosphorescent during putrefaction; even affording light sufficient to read by. An instance in point is mentioned in the Edinburgh Philosophical Journal, in which an officer on guard at Strasburgh thought the barracks were on fire, so great was the light emitted from a cellar filled with potatos in an incipient state of decomposition.

(4526.) Two other species of *Solanum*, viz. *S. Valenzuela* and *montanum*, form fleshy tubers, which are edible; but they are little used.

(4527.) *Solanum Æthiopicum* is cultivated in China for the sake of its fruit, which is prized by the Mandarins as an article of dessert; and *S. Melongena* and *ovigerum* are the egg-plants, the fruit of which, as well as that of *S. muricatum*, and some other species, is esculent. The egg-plants, when boiled or stewed in sauces, form a very pleasant food.

(4528.) The *Apples of Sodom*, of which such wonderful descriptions were given by Josephus, Tacitus, and some of our earlier English writers, for example, the veracious Mandeville, that their accounts were wholly disbelieved, have been shewn by Haselquist to be the fruit of a species of *Solanum*, which he calls *Melongena*, but which is now distinguished under the name of *S. Sodomeum*. This fruit is found, he says, in abundance round Jericho, and in the vicinity of the Red Sea. The cinder or ash-like dust, with which it is sometimes filled, is the work of an insect, which deposits its eggs within the germen, and, as the fruit enlarges, the larvæ, as in the case of nuts, grain, &c. destroy and pulverize the whole of the inner parts, leaving the rind entire and unchanged in external appearance, excepting being heightened in colour. But when the apple is gathered, the delusive shell is crushed by the pressure of the hand, or, if bitten, the mouth is filled with an ash-like powder, exceeding bitter to the taste. From this it would appear that Mandeville's account of these apples is almost strictly true, and, though couched in obsolete language, may be worth quoting. After describing the Dead Sea and its shores, he says, " And there besydan growen

trees that baren fulle faire apples and faire of colour to beholden, butte whosoe breketbe them or cuttethe them in two he shall find within them coles and cyndres." Milton, with the supremacy of genius, has appropriated this legend, and made fine use of it, in the passage where he describes the transformation of Satan and his angels into serpents, who are tempted to eat the apples grow ing on trees resembling the forbidden tree of knowledge:

> " ——— Greedily they pluck'd
> The fruitage fair to sight, like that which grew
> Near that bituminous lake where Sodom flamed.
> This more delusive, not the touch but taste
> Deceived, they fondly thinking to allay
> Their appetite with gust, instead of fruit
> Chewed bitter ashes."

(4529.) *S. Dulcamara,* the bitter-sweet or felon-wood, is a deleterious plant, both fruit, leaves, and stem being equally poisonous. It has, however, been employed medicinally, and appears to be serviceable, both internally administered, and used as a wash in lepra, psoriasis, and other cutaneous disorders. It is narcotic and diaphoretic, and is said to have been exhibited with advantage in asthma. *S. nigrum,* the blackberried nightshade, seems to be a more certain narcotic than the preceding species; and Orfila says its extract possesses nearly the power of lettuce-opium. *S. Jacquini* is reputed in India to be an expectorant, and the juice of *S. Bahamense* has been recommended in the West Indies as a gargle for sore throats. *S. pseudo-quina* is intensely bitter; it is called the *Quina* of Brazil, and there it is believed to be as powerful a febrifuge as cinchona; indeed, the Brazilians, it is said, will hardly be persuaded that it is not the real Jesuit's-bark.

S. paniculatum, S. baccatum, and *S. mammosum,* are also esteemed in the same country as diuretics. The fruit of the latter is a deadly poison.

(4530.) *Lycopersicum esculentum* is the *Tomato,* of which there are three principal varieties, the white, red and yellow fruited. These are all esteemed, especially by Italian cooks, and they certainly make excellent sauces. The generic name is a hybrid compound, signifying the wolfish peach, and, like the English name, love-apple, is meant to infer the deceitful character of the specious berries; in appearance they are more tempting than a peach, but as a fruit they are worthless.

(4531.) *Capsicum* is the bird or Cayenne pepper. *C. baccatum* is the species most esteemed as a condiment; but *C. annuum, luteum, frutescens, minimum,* &c. are all more or less powerful spices; indeed, the last named is so extremely pungent, that it has been called the mad-spice. Its powder is sometimes mischievously mixed with snuff, and the sneezing it provokes is most violent and distressing. The dish called *Man-dran* in the West Indies, and which is resorted to in order to excite an appetite, and which is said to be sure to do so in the most languid condition of the digestive organs, is a mixture of bird-pepper, shallots or onions cut very small, a little lime-juice, Madeira wine, and sliced cucumbers.

(4532.) *Physalis Alkekengi* is the common winter-cherry. In this country it is chiefly grown as an ornamental plant, and as furnishing good winter beaupots. In Arabia and Armenia, however, and even in Germany and Spain, the cherry-

like fruit is eaten as a dessert. It has a subacid and not unpleasant taste, but the persistent calyx with which the berry is invested is very bitter. Ray speaks of alkekengi berries as a preventive of gout, and others have extolled them as diuretics, and recommended them in the treatment of dropsy. In India a decoction of the root of *P. flexuosa* is said by Ainslie to be esteemed as a diuretic, and even as an alexipharmic; and its leaves steeped in oil are used as topical applications to inflammatory tumors. *P. pubescens* is the *Camaru* of Brazil; its fruits are esculent, and, when preserved with sugar, make an excellent sweetmeat. Feuillée says that its leaves in decoction are useful as a diuretic. *P. sommifera* is reputed to possess narcotic powers, which are not wholly absent from the other species, but in them the effects of the sedative principle are cancelled by the presence of acid. In Egypt and Arabia its leaves are applied to wounds, and are believed to assuage the anguish of local injuries. This plant has been recognized in the Egyptian mummies by Kunth.

(4533.) *Lycium barbarum* is a plant which has a wide geographical range, being found in France, and also in Japan; and, although not a native, it is almost naturalized in Britain. It is here very commonly called the *tea-plant,* and an infusion of its leaves has been recommended as a substitute for the Chinese herb. Its fruits are not deleterious, but certainly not pleasant enough to be considered eatable. The young shoots of *L. Europeum,* which grows commonly in the hedges in Spain, form, when blanched, a very good substitute for asparagus. In New Grenada *L. umbrosum* is said to be used medicinally in the treatment of erysipelas.

(4534.) *Solandra grandiflora, nitida,* and the other species of this genus dedicated to the memory of a very meritorious botanist, bear most splendid blossoms. They are, however, deleterious or suspected plants, possessing narcotic properties, but not sufficiently pronounced to render them serviceable as medicines. The *Brunfelsiæ* are also very handsome plants.

(4535.) The calabash-trees of the West Indies and the American Continent are different species of *Crescentia.* *C. cucurbitina* is the round, and *C. Cujete* the oval-fruited calabash. The fleshy pulp of the fruit of both is deleterious, but that of the former is said to be very poisonous. Tussac relates an instance in which five soldiers died from eating it in mistake for cucumbers. The latter is less venomous, but it is never eaten, although the natives attribute wonderful remedial powers to it when used as a charm or medicine: and an allied species, *C. edulis,* which by some is indeed thought to be only a variety of the preceding, bears wholesome fruit, the fleshy part of which is commonly eaten in New Spain.

The most important part of the calabashes is however their rind, which is tough, and the negroes apply it to a vast variety of purposes; the largest form vases or casks, in which wine is kept, and some are made into musical instruments. The small fruits are scooped out, and their rind made into cups and mugs, larger ones into bowls, covered basons, and saucepans. Sections of the rind are converted into plates and dishes, the smaller fragments fashioned into spoons, ladles, skimmers, and all the furniture of the kitchen. These vessels, which has often caused needless surprise, bear the action of fire when water is in them, thus affording a good illustration of a philosophical principle. Sometimes they are plain, and sometimes highly ornamented with paintings. The calabash of Africa (olim *C. pinnata*) is now called *Tripinnaria Africana.*

(4536.) *Cestridæ*. *Cestrum*. The normal genus of this, the last subtype of the *Solanaceæ*, includes many suspected species, and several very poisonous ones. *C. auriculatum*, the *Heduinda* of the native Peruvians, is remarkable for having a pleasant musky odor at night, but being very fetid during the day. Martius says, it, as well as *C. laurifolium*, is reputed to be a febrifuge, and both are used externally as astringents. The berries of *C. nocturnum*, which are very deleterious, appear to be more fatally poisonous when introduced into a wound than when taken into the stomach. This species also exhales a delicious perfume after nightfall. *C. Parqui*, on the contrary, has a very offensive smell, but, notwithstanding its ill odor, it has been used in decoction, in Chili, as a remedy for tinea capitis. The juice of the berries of *C. tinctorium*, which is a native of New Grenada, forms a fine blue ink, almost indestructible, which used to be employed by the viceroy in all his official communications. Other species, as *C. vespertinum* and *Parqui*, yield a bluish liquid, but inferior to that of the *C. tinctorium*. *C. venenatum*, as its name imports, is poisonous, and perhaps it is the most deleterious of all the species. It is said to be with the juice of its berries that the boshiesmen of the Cape of Good Hope envenom their arrows, or at least, that it is one of their fatal poisons. They likewise use it to destroy wild beasts, by impregnating baits of flesh with its juice. *C. macrophyllum* would appear, from the account given of it by M. Descourtilz, to be nearly as potent a poison as the preceding.

(4537.) Polemoniaceæ. The Greek *Valerian* (*Polemonium*), and its allies, *Ipomopsis*, *Collomia*, *Phlox*, and *Cantua*, with perhaps *Cobæa*, are herbaceous (rarely fruticose) plants, with erect stems, or, as in *Cobæa*, a climbing one, and sometimes nodoso-articulated ; the juices are aqueous, the leaves are opposite or alternate, simple or compound, sessile or petiolated, and destitute of stipules.

The inflorescence is paniculate, corymbiform or subcapitate, seldom solitary, and the flowers are regular and united.

The calyx is free, synsepalous, herbaceous, persistent, 5- (seldom 3-4) parted, and sometimes irregular. The corolla is hypogynous, deciduous, synpetalous, and equal, and normal in its relative situation with the calyx: the limb is 5-lobed, imbricate, or at least, not plicate in æstivation. The disk annular and hypogynous. The stamina are definite (5), exserted from the base or middle of the tube of the corolla, and alternate with its lobes. The filaments are free, the anthers 2-celled, incumbent, the locules parallel and contiguous, and dehiscent lengthwise by chinks, and the pollen mostly blue. The germen formed of 3 connate carpels, 3-celled, and the placentæ central, and 1 or many-ovuled. The style 1, and the stigmata 3.

The fruit is capsular, 3-valved, 3-celled, with a loculicidal or septicidal dehiscence, the valves separating from the axis, which is a central 3-cornered column. The cells are 1 or many-seeded, the seeds are ascending or peltate, angular or oval, or winged, sometimes enveloped in a bed of mucus, and covered with spiral threads. The albumen fleshy or horny, the embryo straight and included, the radicle inferior, and the cotyledons foliaceous, elliptical or plane.

(4538.) Hence, differentially considered, the *Polemoniaceæ* are herbaceous non-lactescent *Solaninæ*, with regular pentandrous flowers, 5-lobed calyx and corolla, imbricate in æstivation, and the pollen mostly blue. The germen 3-valved, 3-celled, the placentæ central and 3-sided, and the embryo straight.

(4539.) *Cobæa*, which is an aberrant genus, differing from the rest of the *Polemoniaceæ* in habit as well as in other particulars, and which has sometimes been even excluded from this group, and associated with the *Bignoniaceæ*, (vide Bart.), has been made by Don the typical genus of a separate tribe, but, as the essential differences are few and slight, it may be sufficient to admit it as a subtype, and thus to divide the *Polemoniaceæ* into the *Polemonidæ* and *Cobæidæ*.

(4540.) In the former, the *Polemonidæ*, the stem is erect, not twining, the leaves mostly opposite, the inflorescence aggregate, the stamens exserted from the middle of the tube of the corolla, and the dehiscence of the capsule loculicidal;

(4541.) While in the *Cobæidæ* the stem is voluble, the leaves alternate, pinnate, and cirrhose. The inflorescence axillary and solitary, the stamens exserted from the base of the campanulate corolla, and the dehiscence of the capsule septicidal.

(4542.) The *Polemoniaceæ* are very pretty flowers, but further than as garden ornaments they are of little use. Their properties, if any, are confined to a slight degree of astringence, but, like other really inert vegetables, they at one time enjoyed a surreptitious reputation; for Pliny tells us that the *Polemonium* of the ancients was also called *Chilodynamia*, (from χιλιοι and δυναμις,) on account of its numerous virtues and extraordinary merit; and he also relates a legend which attributes its present generic name (a derivative of πολεμος), to a war between two kings, occasioned, as he says, by a disagreement that arose as to which first discovered its uses. It is, however, to be remembered that, although we frequently make use of the same names as the ancients, much doubt often exists as to whether we apply them to the same plants; and it is to be believed that the *Marsh Polemonium* of Hippocrates was the *Gratiola* or hedge-hyssop, a plant possessed of very active properties.

(4543.) The seeds of *Collomia linearis*, like those of *Salvia verbenaca*, form very interesting objects for microscopic observation, as the spiral threads with which the seeds are covered, and which are kept confined and depressed by the mucous coating, as soon as water is applied and the mucilage dissolved, unrol themselves, and extend their spires in a remarkable and beautiful manner.

(4544.) *Phlox*, and the other allied genera, are equally elegant plants with the *Polemonia*; and *Cobæa* is a very handsome one. It is also remarkable for the rapidity of its growth, a single stem having been known to extend itself, in a conservatory, upwards of 200 feet in length during the summer.

(4545.) Convolvulaceæ. *Convolvulus*, and its allies, are herbs or shrubs, with often twining stems, smooth, or covered with a simple down, and in general milky sap. The stems are round or irregularly angled, and not nodoso-articulate. The leaves are alternate, simple, often entire, sometimes lobed, and destitute of stipules.

The inflorescence is axillary or terminal, solitary or aggregate, the peduncles being 1 or many-flowered, and the pedicels in general bibracteate. The flowers are regular and united, often specious.

The calyx is free, herbaceous, and persistent; synsepalous, 5-cleft, (rarely with 10 teeth,) and the lobes imbricate in æstivation. The corolla is hypogynous, deciduous, synpetalous, and equal, tubulose, infundibuliform or subcampanulate, with a 5-lobed limb (rarely 10-lobed), and for the most part plicate longitudinally, and contorted in æstivation. The disk is annular and hypogynous.

The stamens are definite (5), exserted from the base of the corolla, and alternating with its segments. The filaments are often of unequal length, and free: the anthers 2-celled, with apposite locules dehiscent lengthwise by clefts. The germen is formed of 2 connate carpels, 2-4-celled, seldom imperfectly unilocular. The ovules definite and erect; when more than one in each cell they are collateral: styles 2, mostly connate, and the stigmata coalescent or discrete.

The fruit is capsular, 1-4-celled, the margins of the valves corresponding to the angles of a free dissepiment, in general with a septicidal dehiscence, but sometimes opening transversely. The placentæ are central, and bear the seeds at their base. The seeds are erect, the albumen spare, mucilaginous or fleshy: the embryo curved or spiral, the cotyledons shrivelled or absent, and the radicle inferior.

(4546.) Hence, differentially considered, the *Convolvulaceæ* are sublactescent *Solaninæ*, with imbricate calyx and plicato-contorted corolla, a 2-4-celled ovary, definite erect ovules, spare albumen, and shrivelled or absent cotyledons.

(4547.) The genera here associated are distinguished into two subtypes, called, from *Convolvulus* and *Cuscuta*, the *Convolvulidæ* and *Cuscutidæ*.

(4548.) In the *Convolvulidæ* the stems are leafy, the cotyledons 2 and corrugate, and the embryo curved;

(4549.) While in the *Cuscutidæ* the stems are leafless, and the embryo spiral and without cotyledons.

(4550.) *Convolvulidæ.* These plants afford a good illustration of the changes wrought in the properties of vegetables by time, and of the necessity of age to elaborate their peculiar and characteristic principles; for the leaves, the young shoots, the flowers, and even the fruits of the *Convolvulaceæ*, when young, are innocuous, almost inert; and the annual species might be eaten: but in the perennial stems and rootstakes, where the sap becomes decidedly lactescent, an active resin is produced, well known for its powerful cathartic properties. The rootstakes, where this resin the most abounds, are the parts chiefly used as medicines; the stems even of the ligneous species are but slightly acrid, and the fleshy roots, when non-resinous, are esculent, as is the case with the *Convolvulus Batatas*.

(4551.) *Convolvulus*, the normal genus of the type, has been divided into two or three genera, which perhaps would have been sufficiently distinguished had they been considered merely as subgeneric groups. They are called *Convolvulus Ipomæa* and *Calystegia*, and chiefly differ in the number of their seeds and the locules of their ovarium: Ipomæa having a 3-celled capsule and capitate stigma, convolvulus a 2-celled capsule and a 2-cleft stigma, while in *Calystegia* the ovary is 1- or half 2- celled, the stigmata 2 and obtuse, and the calyx invested by 2 leafy bracteæ.

(4552.) *Convolvulus Scammonia*, which is a native of Turkey, Syria, Greece, and Egypt, and which is also found in Persia and Cochin-china, yields a milky juice when its rootstakes are wounded, which concretes on exposure to air, and is known in the drug market as *Scammony*. The value of *Scammony* as a cathartic is admitted on all hands. Still, as it is violent in its action, it ought to be trusted only to skilful hands. It is a very common ingredient in "universal" medicines, and much injury has been occasioned by its empirical use. Between 5 and 6000 lbs. of scammony were imported into England from the Levant in

1829 for home consumption; upon this a duty was levied of nearly 2000*l.*, and its high price renders the drug very subject to adulterations.

(4553.) *C. arvensis,* the common field-convolvulus or bindweed, affords a cathartic resin, but it is less active than that of the *C. Scammonia.* *C. althæoides,* which is a native of France, is likewise known to be possessed of cathartic powers, as are also the roots of *C. corymbosus, macrocarpus, maritimus,* and *Mechoacanha.* The leaves of *C. speciosus* are used in India as emollient poultices to cutaneous diseases. *C. discolor* is reputed to be an astringent; and the roots of *C. edulis,* which are large and fleshy, abound so much in bland farina, and the active resin exists in such small relative proportion, that they form a mild, nutritious, and wholesome food. This plant is thought by some persons to be only a variety of *C. Batatas,* which has long been prized as a delicate vegetable. The *Batatas* is the potato of Shakspeare's time; and, not only were its fleshy roots and young leaves and tender shoots then eaten as potherbs, but they were candied, and made into a variety of sweetmeats. Some of the kissing "comfits" then in vogue are believed to have been made of this sweet potato, as well as of eryngo.

(4554.) The *Lignum rhodium,* or rose-wood of commerce, not that which comes in large blocks for ornamental furniture, but those sorts which occur in smaller pieces, and have a strong and agreeable rose-like odor, are said to be procured from two species of *Convolvulus* common in the Canaries, *C. floridus* and *C. scoparius.* The wood, when powdered, has been recommended as an errhine, and it forms a very pleasant aromatic snuff; the raspings are also used to perfume clothes; it is valued in fumigation, for, when burned, it diffuses through the air a most delightful fragrance; and a very sweet-smelling oil may be distilled from it, which is known as oil of *Rhodes* or *Rhodium.* [§ 2055, 4398.]

(4555.) *Ipomæa Turpethum* is the *Turbadt* of the Arabs; it yields a very active resinous substance resembling scammony, which has been called vegetable *Turpeth,* in contrast to a chemical preparation known under the name of *Turpeth Mineral.* The resinous extract procured from the root of *I. pandurata* is said to be little, if at all inferior to *Scammony;* and in Virginia, and in the United States, it is much esteemed.

(4556.) *Ipomæa* (or *Convolvulus*) *Jalapa* yields that well-known and useful purgative which bears, with the plant from which it is procured, a common specific name. Jalap, when administered in proper doses, is a safe as well as active medicine; most serviceable in indolent habits, and, combined with cream of tartar and ginger, very beneficial in cases of dropsy. It is, however, not to be trifled with, for, if taken in undue quantity, it produces hypercatharsis, and such serious symptoms, that Christison speaks of it as a poison; and says, "this every one ought to know, as severe, and even dangerous effects have followed its use in the hands of the practical joker." Between 2 and 300,000 lbs. are on an average annually imported into this country, and chiefly from Vera Cruz. *I. Braziliensis* yields also a very purgative resin; and the leaves of this species seem to be possessed of active properties; for Ainslie tells us that baths, in which they have been steeped, are employed in India in the treatment of dropsy; and that they are applied to issues to keep up the discharge. A decoction of *I. Coptica* is used in Guinea as a wash to relieve headach; the inspissated juice of *I. pennata* has been employed as an errhine. The powdered leaves of *I. gemella* are considered in India a useful application to aphthous sores. *I. nil, I. repens,* and other species,

possess somewhat similar properties, but in a less marked degree. The latter is boiled as a medicinal potherb, and eaten in the West Indies by dropsical persons, to aid more potent medicines. The leaves of *I. reptans* are eaten as spinach in India, where the plant is called *Cancong;* and the root of *I. paniculata* is said by Rheede to be not only wholesome, but very fattening.

(4557.) *Calystegia sepium* yields a concrescible resinous juice, resembling scammony in its cathartic properties; and the roots both of it and of *C. Soldanella* might be used as substitutes for jalap.

(4558.) The *Convolvuli, Ipomææ, Evolvuli, Argyreiæ,* and their allies, are for the most part very elegant flowers, and sometimes their blossoms are superb. They are deservedly favorites both in the garden and conservatory. An infusion of the leaves of *Evolvulus Alsinioides* is employed by the Tamouls of Hindostan as a remedy in bowel complaints; from their affinities it is probable that most of the species are purgative, but they are not used in European medicine.

(4559.) CUSCUTIDÆ. The *dodders* are rather curious than either useful or ornamental plants; they are not, however, destitute of beauty, and, when luxuriant, they give a very strange appearance to the herbs or bushes on which they grow, covering them as it were with a veil of reddish, leafless stalks studded with blossoms. They are chiefly remarkable for their constant migration from the earth to the substance of some living plant. The seeds, unlike those of other parasites, germinate in the common soil; but, if the seedlings be kept there, they soon wither and die. When in the neighbourhood of a nettle, clover, or other plant, they eagerly twine round it, making their coils from right to left, *i. e.* contrary to the apparent course of the sun; and, after they have inserted their fang-like subsidiary roots within the substance of the vegetable upon which they have seized, the original root, which sustained them for a time, perishes, and their desertion of the soil becomes complete.

(4560.) The *Cuscutidæ,* although not now used in medicine, are reputed to possess cathartic powers; thus shewing their affinity in properties as well as in structure to the *Convolvulidæ,* the shrivelled seed-lobes of which may be thought to be an approach to their acotyledonous embryo: and may not their destitution of leaves and want of cotyledons seem to shew the real nature of these latter organs?

(4561.) HYDROLEACEÆ. The genera *Hydrolea, Sagonea, Diapensia, Nama,* and *Wigandia,* which have been separated by Dr. Brown from the *Convolvulaceæ,* form the connecting link between that type and the *Boraginaceæ,* being perhaps equally related to both the subtypes of the latter. The imbricated æstivation of their corolla, their non-lactescent juices, indefinite seeds, and straight axile embryo, with small flat cotyledons, are discrepancies quite sufficient to justify their separation from the *Convolvulaceæ. Wigandia* agrees in habit with some of the *Boraginidæ,* and, according to Von Martius, the dilated filaments of the *Hydroleaceæ* are analogous to the membranous scales which line the tube of the corolla in *Hydrophylleæ.*

(4562.) The *Hydroleaceæ,* collectively described, are branching herbs or undershrubs, with roundish stems, not nodoso-articulated, but sometimes furnished with axillary spines and non-lactescent juices. The leaves are alternate and simple, entire or lobed, often covered with glandular or stinging hairs, and exstipulate.

The inflorescence is axillary (seldom terminal), solitary, or sub-fasciculate; the flowers sometimes crowded into one-sided spikes (scorpioid cymes?) regular, and united.

The calyx is free, herbaceous, persistent, 5-parted, and imbricate in æstivation; the corolla hypogynous, deciduous, synpetalous, equal, rotate, campanulate or tubulose; the limb in general 5-cleft, but not always agreeing with the calyx in the number of its divisions, and the lobes imbricate (not plicate) in æstivation. The stamina are definite (5), exserted from the tube of the corolla opposite the segments of the calyx, and equal to them in number; the filaments are dilated at the base, regular, and free; the anthers 2-celled, incumbent, with parallel contiguous locules, and deeply lobed at the base; the germen is superior, formed of 2-3 connate carpels, surrounded by an annular disk, 2-3-celled, and the cells many-ovuled; the styles 2-3, distinct; the stigmata the same in number, and thickened.

The fruit is capsular, and invested by the persistent calyx, 2-3-celled, 2-3-valved, with the valves sometimes bipartite; the dehiscence loculicidal, the valves bearing the bilamellate dissepiments on the median lines (rarely circumscissile); the placentæ are either double and thin, or by union single and incrassated, adnate to the dissepiments, and polyspermous; the indefinite seeds are minute, exarillate, and the testæ altogether naked; the albumen fleshy, but often spare; the embryo taper, straight, and axile, and included in the albumen.

(4563.) Hence, differentially considered, the *Hydroleaceæ* are non-lactescent *Solaninæ*, with an imbricated corolla, a superior 2-3-celled germen, with as many discrete styles as cells, minute indefinite seeds, a straight axile embryo, and fleshy albumen.

(4564.) The *Hydroleæ* are aquatic plants, with shining viscous leaves, that look as if they were smeared with oil; whence indeed the generic name. De Candolle states that their properties are similar to those of the *Convolvulaceæ*, from which they have been dissevered; but very little regarding their qualities is known, excepting that *H. spinosa* is bitter.

(4565.) Boraginaceæ. The *Borage* and its typical allies are herbaceous, shrubby, or even arborescent plants, with roundish stems, and alternate (very seldom opposite,) simple leaves, destitute of stipules, but with the cuticle both of leaves and branches in general rough, being covered with more or less rigid hairs.

The inflorescence is mostly terminal, sometimes axillary, seldom solitary, in general in scorpioid, paniculate, or corymbiform cymes; the flowers regular (rarely irregular) and united.

The calyx is free, 5- (seldom 4) cleft, and persistent, often changed and increased after flowering. The corolla is hypogynous, synpetalous, regular, (or slightly irregular, as in *Echium*,) 5- or sometimes 4-cleft, and the segments imbricate in æstivation, occasionally furnished with faucial scales. The torus is hypogynous and disciform. The stamens are definite (5 or 4), exserted from the corolla, alternating with its lobes, which they equal in number, straight during æstivation in two of the subtypes, inflexed in the third (the *Hydrophyllidæ*); the filaments are free, and the anthers 2-celled, and dehiscent longitudinally by chinks. The germen is formed of 2 or 4 carpels, either deeply 4-lobed, being connate only at their bases, or wholly concrete, hence the ovary is quadripartite

and 4-ovuled; or simple and 2-4-celled: with definite pendulous ovules. The style is single, and either arising from the centre and base of the ovary when lobed, or terminal when the carpels are wholly united; it is in general undivided, sometimes, as in *Hydrophyllidæ*, cleft, and the stigma simple or bifid.

The fruit is akeniaceous or capsular, being 4-lobed and the lobes separable, or 4-2, or by abortion 1-celled, the pericarp mostly dry and coriaceous, sometimes osseous, seldom fleshy; the cells or akenia are monospermous, the seeds pendulous, and separable from the pericarp. The albumen absent from the *Boraginidæ*, wanting or spare in the *Heliotropidæ*, but abundant in the *Hydrophyllidæ*. The embryo is inverted, the radicle superior, and the cotyledons plano-convex.

(4566.) Hence, differentially considered, the *Boraginaceæ* are asperifolious *Solaninæ*, with non-lactescent mucilaginous juices, a quinary disposition of the flowers and a quaternary one of the fruit, definite pendulous seeds, and an inverted embryo.

(4567.) The *Boraginaceæ* have been subdivided by different systematists, according to their views of affinity, into two, three, four, or even five minor orders. Three of these, to which *Hydrophyllum*, *Heliotropium*, and *Borago*, give names, as the respective normal genera of each, appear sufficiently distinct to be admitted as subtypes, but the others can only be regarded as subtypical districts.

(4568.) The *Hydrophyllidæ* are herbaceous *Boraginaceæ*, with opposite or alternate, hispid, lobed leaves, a 2-scaled nectary at the base of each lobe of the corolla, a 1-celled or sub-bilocular germen, parietal placentæ and indefinite ovules, or the ovules definite, and the placentæ stalked and fungous, a terminal continuous style, and abundant subcartilaginous albumen.

(4569.) The *Heliotropidæ* are herbaceous or arborescent *Boraginaceæ*, with scabrous alternate leaves, a 2 or 4-celled ovary, few ovules, terminal continuous style, and albuminous or exalbuminous seeds;

(4570.) While the *Boraginidæ* are herbaceous or shrubby *Boraginaceæ*, with the hairs enlarged at their bases, the ovarium deeply 4-lobed, the style central and basal, and the seeds solitary and exalbuminous.

(4571.) *Hydrophyllidæ.* *Hydrophyllum*, *Eutoca*, *Ellisia*, *Phacelia*, and *Nemophila*, which are segregated to form this subtype, very closely resemble the *Boraginidæ* and *Heliotropidæ*, with which they are associated. The twin-scaled basal nectary and 1-celled or sub-bilocular ovarium, will, however, sufficiently distinguish them. The fungous-stalked placentæ, when present, is also a very peculiar and characteristic structure. They are natives of the South American Continent; from their affinities it is probable that they are innocuous mucilaginous plants, but their properties are experimentally unknown.

(4572.) *Heliotropidæ.* Three modern natural orders, called *Ehretieæ*, *Cordieæ*, and *Heliotropieæ*, are associated as districts of this subtype; for, although these groups exhibit some interesting structural gradations, their differences are not sufficient to warrant a more distant segregation.

(4573.) The arboreous genera, such as *Cordia*, *Cordiopsis*, *Geraschanthus*, *Cerdana*, *Varronia*, and *Menais*, in which the leaves are harsh and scabrous, the fruit drupaceous and 4-celled, the cells 1-seeded, and the seeds exalbuminous with plaited shrivelled cotyledons, form the district *Cordieæ*.

(4574.) *Ehretia*, *Tournefortia*, and the other arboreous or shrubby genera,

with a 2- or more celled ovarium, containing as many seeds as there are true cells, in which the fruit becomes drupaceous, and the seeds are furnished with a thin fleshy albumen, are associated to form the *Ehretieæ;*

(4575.) While the herbaceous or suffrutescent genera, with a 4-celled drupaceous fruit, separable into 4 pieces when mature, each lobe or cell being monospermous, the seeds exalbuminous, and the embryo with plano-convex fleshy cotyledons, form together the district *Heliotropieæ.*

(4576.) The gradations of structure are very beautiful, as traceable in the modifications of these districts, from the confines of the preceding to those of the succeeding groups. In the *Cordieæ* and *Ehretieæ* the carpels are strictly connate, as in the *Hydrophyllidæ*, and, by the occasional abortion of a part, the ovary is sometimes 1-celled in *Cordia* and its allies, as it also by abortion becomes uni- or sub-bilocular, in *Hydrophyllum* and its associates; while, on the other hand, the drupaceous fruit becoming separable, anticipates the 4-lobed ovary or tetrakenium of the *Boraginidæ.* The albumen being present in the *Ehretieæ* approaches them to the *Hydrophyllidæ*, while its absence from both the *Heliotropieæ* and *Cordieæ* approximates them in an equal degree to the *Boraginidæ*, in which the seeds are exalbuminous.

(4577.) *Cordieæ.* Of the properties of these plants there is not much known. The fruits of the *Cordieæ* are eatable; they are of the size of an olive, and have a sweetish flavor. *C. sebestena* is the sebester plum of the West Indies, and *C. Myxa* supplies its place in the East. When macerated in water these drupes form a mucilaginous fluid, that is used as a demulcent in the same manner as the jujube is with us; the bark of *C. Myxa* is said to be valued in Java as a febrifuge; and a decoction of the leaves of *C. rotundifolia* is esteemed by the Peruvians as an emollient collyrium in ophthalmia.

(4578.) *Ehretieæ.* The fleshy fruits of *Beureria succulenta* and *Ehretia tinifolia* are esculent, but not much esteemed; the latter are called in the West Indies *Cabrillete.* And the bark of the root of *E. buxifolia*, we learn from Ainslie, is believed in Hindustan to be an antidote to the bites of poisonous serpents; it has also there been long held in high repute as a restorative after long and severe diseases, and as a regenerator in cachetic habits.

(4579.) *Heliotropieæ.* Some of the *Heliotropia* are very fragrant plants, such as *H. Europæum; H. grandiflorum*, and *H. Peruvianum*, hence they are favorite garden-flowers; and the latter is consumed in large quantities by the perfumers. They are slightly astringent as well as mucilaginous, and poultices made of their leaves and flowers have been applied to cancerous, scrofulous, and gangrenous sores, for which purpose their sweet scent would also recommend them. Their expressed juice when mixed with salt, was once thought serviceable in the removal of warts, and hence by the Latins the European species was called *Verrucaria.*

(4580.) *Boraginidæ.* These are all innocuous plants, chiefly characterized by their mucilaginous properties and the occasional presence of colouring matter; hence some are used as demulcents and others as dyes.

(4581.) *Borago officinalis* was once much esteemed as a pectoral medicine, and a decoction of its leaves mixed with honey makes a very good ptisan. *Pulmonaria officinalis* was formerly extolled as a remedy for consumption, but further than as a cooling and soothing drink it seems to possess no claims to consideration.

These plants contain nitre in considerable quantities, which is made evident by their crepitating when burned; and to this salt they are indebted for their refrigerant properties. In the north of Europe *P. officinalis* is eaten as a potherb; and, according to Ray, in his time it was brought to table in Scotland. The borage, Withering says, may also be eaten as a salad or a potherb. Its flowers form an ingredient in the "cool tankard" of our topers, and the whole plant was once considered a potent cordial and stomachic; indeed, its name is said to be a corruption of *Cor-ago*. The *Myosotides* are likewise mucilaginous and slightly astringent, and have been used in decoction as *Collyria*, and the leaves bruised and made in emollient poultices, which are said to be serviceable in inflammation of the eyes. They are, however, very seldom employed in medicine, but are especial favorites, from the delicacy and simple modest beauty of their flowers: perhaps they owe some part of their popularity to their provincial name "*Forget-me-not.*"

(4582.) The *Lithosperma* are remarkable for the stony hardness of their pericarps, which have all the brittleness and lustre of porcelain. This membrane, when analyzed, is found to contain a larger quantity (nearly 60 per cent.) of earthy matter than any other known organized substance. *L. officinalis*, from its stone-like fruit, was esteemed, when the doctrine of signatures prevailed, an infallible lithontriptic: it is needless to add, that its reputed virtues in that respect were all imaginary. The *Symphyta* were formerly in much repute as vulneraries; indeed, their name has reference to the *unions* they were believed to form. *Cynoglossum officinale* was also once employed as a medicine: it was esteemed as an antispasmodic, but it is so fetid that it has long since ceased to be exhibited.

(4583.) Several species of *Anchusa* have roots which abound in a red colouring matter, useful as a dye: this, which is considered a peculiar proximate principle, has been called by John *Pseudo-alkannin*. *A. tinctoria* is the common *Alkanet* or *Orcanette*, much in request by druggists to color oils, wax, &c. Lip-salves, many plasters, and the composition often sold as port-wine, owe their tints to this dye-stuff, which is also used to stain corks, so as to give false circumstantial evidence of the *wine* having been some time in bottle. *A. Virginiana* and *Echium rubrum* have roots almost equally rich in colouring matter with the true *Alkanet*, and are used as substitutes for it.

GENTIANINÆ.

(4584.) *Gentiana*, *Strychnos*, and *Logania*, are the normal genera of three natural families, hence called *Gentianaceæ*, *Strychnaceæ*, and *Loganiaceæ*, which are included in the present section, the *Gentianinæ*, named by Bartling from the æstivation of the corolla, the *Contortæ*. Other orders, of which *Spigelia*, *Menyanthes*, *Stapelia*, *Apocynum*, and *Potalia*, are examples, have been separately described or proposed to be distinguished. These, however, seem to be only subordinate groups, and are therefore for the present, at least, admitted merely as subtypes.

(4585.) Collectively considered, the *Gentianinæ* are hypocorollous *Syringales* or *Primulosæ*, with opposite, simple, (rarely alternate compound leaves,) regular flowers, corolla contorted, rarely valvate in æstivation, stamina alternate with the lobes, and the germen superior and formed of 2 (accumbent) carpels.

(4586.) GENTIANACEÆ. The Gentians, and their typical allies, are herbaceous

plants, rarely shrubs, for the most part smooth, with aqueous juices, nodose stems, and round, compressed or tetragonal internodia. The leaves are opposite, (rarely compound or alternate, as in the *Menyanthidæ*,) sessile or petiolate, and destitute of stipules, or only substipulate.

The inflorescence is terminal or axillary, in general solitary, sometimes aggregate, and either racemose, fasciculate, or corymbiform. The flowers regular and united.

The calyx is free, persistent, definitely divided (often 4-5-cleft), and the laciniæ imbricate in æstivation. The corolla is hypogynous, marcescent (rarely deciduous), synpetalous, the limb equal, 4-5- (seldom 6-8) cleft, the lobes alternate with the segments of the calyx, and imbricato-contorted, rarely valvate in æstivation; and sometimes with coronal appendages in the faux. The disk absent in all except *Tachia*, in which it is hypogynous. The stamina definite, exserted on the same level from the corolla, alternately with its lobes, which they equal in number, or are occasionally by abortion less. The filaments are free, the anthers 2-celled, incumbent, and dehiscent by chinks or pores. The pollen 3-cornered,

C

Gentiana lutea.

A. Leaf and inflorescence.

(*a*) An entire flower separated.

(*b*) The fruit formed of 2 accumbent carpels.

(*c*) Transverse section of the same, to shew the incurved edges of the valves.

(*d*) A seed.

(*e*) Longitudinal section, to shew the straight axile embryo included within the albumen.

(*f*) The embryo isolated.

3-lobed, or triple. The germen is formed of 2 accumbent carpels, connate, or with introflexed margins; 1-2-celled and many-ovuled. The styles 2, for the most part connate, articulated with the ovary or continuous, and the stigmata coherent or discrete.

The fruit is capsular, rarely baccate, mostly 2-valved, 1-2-celled, the dissepiment when present formed of the introflexed valves, which in the 1-celled fruits bear the placentæ on their edges, and in the 2-celled ones the trophosperms are central, the seeds are numerous, small, exarillate, and attached to the placentæ by short podosperms. The albumen soft and fleshy, the embryo straight, axile,

and included, the radicle next the hilum, and the cotyledons foliaceous in germination.

(4587.) Hence, differentially considered, the GENTIANACEÆ are bitter, non-lactescent *Gentianinæ*, with opposite or alternate, exstipulate or substipulate leaves, a marcescent corolla, ternate pollen, a 1-2-celled germen, formed of 2 accumbent carpels, and several or many seeds, with fleshy albumen.

(4588.) Two chief deviations are noticeable from the normal structure of this type, and of these *Menyanthes* and *Spigelia* are examples. Hence the associated genera are distributed into three subtypes, the *Menyanthidæ*, *Gentianidæ*, and *Spigelidæ*.

(4589.) The *Menyanthidæ*, including *Menyanthes* and *Villarsia*, have alternate, exstipulate, sometimes compound leaves, a contorto-imbricate corolla, and a dry capsular fruit.

(4590.) The *Gentianidæ* have alternate, simple, exstipulate leaves, a contorto-imbricate corolla, continuous style, and the fruit capsular or baccate;

(4591.) While the *Spigelidæ*, comprehending the solitary genus *Spigelia*, have opposite, simple, stipulate, or substipulate leaves, a valvate æstivation of the corolla, and an articulated style.

(4592.) The *Gentianaceæ* are innocuous plants, remarkable for their exceeding bitterness, which makes them unfit for food, but at the same time renders them valuable tonic and stomachic medicines. The untoward symptoms sometimes observed to follow the administration of what has been supposed to be gentian, have been proved to be owing to the *Veratrum album*, which grows in the same districts, and has some slight resemblance to it, having been collected in mistake.

(4593.) *Gentiana lutea* is the species most commonly employed in British medicine: but its place is supplied in Norway and Germany by *G. purpurea;* in Russia by *G. Pneumonanthe* and *G. Amarella;* and in the United States of America by *G. Catesbæi*. Other species, such as *G. acaulis, G. campestris, G. punctata, G. biloba, G. cruciata, G. macrophylla*, &c. might be employed, if need arrived. The latter is thought to have some soporific influence, and has been said to relieve watchfulness, and to procure sleep during delirious vigils. The chief use made of the gentians is as tonics. *G. Chirita* is the celebrated Indian stomachic. They have also been employed as febrifuges and anthelmintics, and likewise as gout medicines. The base of the famous Portland powder is said to be gentian. As their roots contain a considerable proportion of sugar, an intoxicating liquor has been made from them by fermention, and from this a spirit distilled which in Switzerland is called *Gentianwasser*.

(4594.) *Erythræa Centaurium*, the different species of *Chironia* and *Sabbatia*, the *Coutoubeæ* and *Lisianthi*, with our native *Menyanthes*, are all excellent bitters; and, did not our catalogues already groan, they might be added to the lists of materia medica. *Frazera Walteri* yields a powerful bitter, nearly as pure as that of *quassia*, and wholly destitute of aroma; and the bitter root of *Tachia Guianensis*, which exudes a yellow pellucid resin in the axillæ of its leaves, is esteemed as a febrifuge.

(4595.) The bitterness of many of the *Gentianaceæ* has recommended them as vermifuges; but *Spigelia Marilandica*, which, besides being bitter, is a violent purgative, has been very much extolled as an anthelmintic, and is commonly

known under the name of the *Maryland Worm-grass*. *S. Anthelmia* is equally effectual as a vermifuge; but both are said to possess narcotic properties; and very unpleasant symptoms, such as dimness of sight, giddiness, dilated pupil, and convulsions, have followed their exhibition.

(4596.) Strychnaceæ. The genera associated to form this type contain herbaceous, shrubby, or arboreous plants, with roundish, sub-articulated stems, sometimes angled and fleshy; the sap usually lactescent; the leaves opposite, occasionally whorled, rarely alternate, simple, exstipulate, but often furnished with petiolar or intrafoliaceous glands or ciliæ.

The inflorescence is axillary or terminal, solitary or aggregate, sertulate, racemose, or paniculate, and the flowers regular, symmetrical, and united.

The calyx is free, persistent, equal, synsepalous, and 5-cleft; the corolla hypogynous, deciduous, synpetalous, 5-lobed, or 5-cleft, often with faucial appendages, and contorted or imbricate, rarely valvate in æstivation; the stamens are definite (5), exserted from the corolla, alternating with its segments, equal to them in number, and opposite the lobes of the calyx; the filaments are mostly free

A. *Asclepias Syriaca*. Cutting, to shew leaves and inflorescence.

(*a*) A bud.
(*b*) One entire flower.
(*c*) Follicular fruit open.
(*d*) Transverse section of the fruit.
(*e*) A seed.
(*f*) Vertical section of ditto, shewing the double pappus and embryo within the albumen.
(*g*) The embryo detached.

B. *Stapelia hirsuta*. Entire plant.

(*a*) Flower separated, and the petals removed.
(*b*) A stamen, with its appendage.
(*c*) The cells of the anther.
(*d*) Masses of pollen removed from the anther-case, and cohering.
(*e*) The twin accumbent carpels.
(*f*) Transverse section of the ovary, to shew the placentæ and numerous seeds.

in one subtype, the *Apocynidæ*, and mostly connate in the other, the *Stapelidæ*; the anthers are 2-celled, or sometimes sub-quadrilocular, by means of incomplete dissepiments, and free or coherent round the stigma; the pollen granulate, globose, or 3-lobed, and applied immediately to the stigma in *Apocynidæ*, but usually cohering in masses, rarely pulverulent, in *Stapelidæ*; the germen is formed of two accumbent carpels, mostly discrete, sometimes connate; the placentæ are central or sutural, and many-ovuled; the styles 2, discrete or connate; the stigma simple in the *Apocynidæ*, but in the *Stapelidæ* it is dilated, 5-cornered, and common to both styles.

The fruit is very variable, mostly follicular, but sometimes capsular, drupaceous, or baccate, and double or single, 2-celled, or by abortion 1-celled, and 1 or many-seeded; the seeds are pendulous, often comose or ciliate near the hilum, sometimes naked, albumen present, but variable, mostly fleshy and scanty, sometimes cartilaginous or horny, or even occasionally ruminate; the embryo almost always straight; cotyledons foliaceous; the plumula inconspicuous; the radicle superior in *Stapelidæ*, but in the *Apocynidæ* turned towards the hilum.

(4597.) Hence, collectively and differentially considered, the *Strychnaceæ* are mostly lactescent *Gentianinæ*, with opposite (seldom alternate), exstipulate leaves, imbricate or imbricato-contorted corolla, and foliaceous embryo.

(4598.) This type has been variously subdivided, and both collectively and disjunctively received many different names, which it would be useless now to repeat. Brown has separated the genera into two groups, which form the two subtypes, *Apocynidæ* (or *Apocyneæ*) and *Stapelidæ* (or *Asclepiadeæ*.) But so similar are these subtypes in all points save the economy of their stamens and pistils, that were not the deviations of an extraordinary kind, they would not justify even a subtypical division. As it is, *Periploca* forms a connecting link between the two, having one of the chief peculiarities of both, and not the entire characteristics of either; for its stigma is tubular and dilated, like the rest of the *Stapelidæ*, while its pollen is granular, like the *Apocynidæ*. Furthermore, there is a similar exception in each to the normal æstivation of the corolla; for in *Gardneria* of the latter, and *Leptadenia* of the former, it is valvate, instead of being imbricate or imbricato-contorted.

(4599.) It is in the *Stapelidæ* that the principal deviations from the ordinary condition of the stamens and pistils occurs; for, while in the *Apocynidæ* the stamens are discrete, the pollen powdery, and the thickened capitate stigma in an ordinary state, in the *Stapelidæ* the filaments are mostly connate, and confounded with the pistil, the pollen waxy and coherent in masses, and the stigma dilated, the tabular expansion being common to both styles. The similitude of this structure with that of the *Orchidaceæ* is striking, and the mode of fertilization in both series was long a problem. Much light has, however, been lately thrown on the subject by Dr. Brown, and a most interesting statement published by him, in the Transactions of the Wernerian Society of Edinburgh, and in those of the Linnean Society of London.

(4600.) The *Apocynidæ* are hence, differentially considered, normal *Strychnaceæ*, with a cortorted corolla, discrete stamens, pulverulent pollen, and simple stigma;

(4601.) While the *Stapelidæ* are deviating *Strychnaceæ*, with an imbricato-contorted corolla, gynandrous flowers, waxy pollen, and a dilated tabular stigma.

(4602.) *Apocynidæ.* The plants contained in this subtype are remarkable for the activity of the principles they elaborate. They are in general suspicious, some highly poisonous, others merely acrid and stimulating, and but very few innocuous. Among the more important genera there may be enumerated as examples *Strychnos*, *Cerbera*, *Nerium*, *Wrightia*, *Echites*, *Tabernæmontana*, *Apocynum*, and *Urceola*; to which might be added *Vinca*, *Carissa*, *Plumiera*, *Carpodinus*, and others.

(4603.) *Strychnos Nux Vomica*, the poison-nut or *Koochla* of Hindustan, has become well known to every one, from its fearful and fatal powers. The seeds

of this plant contain two distinct principles, the one called *Strychnia* and the other *Brucia;* both are acrid narcotics, but the former the most energetic in its action, although the latter is likewise a very potent poison. To these principles the poison-nuts owe their power, and in their natural condition they are combined with an intensely bitter substance, which in some allied species predominates over the alkaloids. The seeds are so hard as to resist reduction into powder by the pestle, and require to be rasped or filed; and, when thus prepared, have long been employed to destroy wild or troublesome animals, such as dogs, cats, hares, foxes, rats, and other vermin; and hence its vulgar name of *Ratsbane.* Its action on man is similar to its effects on animals; shortly after being taken, it produces symptoms of intoxication, followed by spasmodic contractions, especially of the muscles of the spine, severe tetanic convulsions, coldness, tremors, and death. Its inebriating properties have led, according to general report, to its occasional introduction into beer, to render that liquor heady; and it is said to be steeped in spirits, or employed in their distillation, to increase their intoxicating powers. The extraordinary influence it exerts over the motor nerves, as evidenced by the spasmodic action of the muscles of the spine; and the general convulsions which its exhibition brings on, suggested the idea that it might be advantageously employed in the treatment of paralysis. And, although every thing which was once hoped for has not been obtained, still, from the reports of *Magendie, Fouquier,* and *Dr. Bardsley,* it is evidently a very valuable remedial agent, for its use has been attended, in many cases, with the most decided advantage; and in some with complete success. (Vide *Med. Bot.* lii.)

(4604.) *Strychnia* has been detected in other species of this genus, as in *S. Sancti Ignatii, S. Tieute,* &c.: the latter of which affords the formidable *Upas tieute,* one of the fearful Java poisons. *Strychnia* is also present in the *Ourari* or *Woorara,* the equally destructive poison of Guiana, which is not improbably prepared from some unknown species of this genus, or of one nearly allied to it. Nor need we discredit the marvellous accounts we read of their virulence, when we know that a single grain of *Strychnia* will destroy a large dog; that *Loureiro* poisoned a horse by an infusion of one of the nuts, and that half a grain, blown from a quill into the throat of a rabbit, has extinguished life, amidst horrible convulsions, in less than five minutes. Indeed, Christison says, "I have killed a dog in two minutes with the *sixth* of a grain, dissolved in alcohol, and injected into the chest; I have seen a wild boar killed in the same manner with a *third* of a grain in ten minutes; and there is little doubt that *half-a-grain* thrust into a wound would kill a man in less than a quarter of an hour." It acts, in whatever way exhibited, but much the most rapidly and energetically when introduced into wounds, or injected into a vein.

(4605.) Notwithstanding the virulence of the seeds, the pulpy pericarp of the *Strychnos nux vomica* is innocuous; it is constantly fed on by birds, and has been eaten by man without injury; the fruit of *S. pseudo-quina* is also esculent; and Caillaud mentions a Nubian *Strychnos,* the fruit of which is sweet and not unwholesome. The Madagascar swine feed on the fruit of *S. spinosa;* and in Peru those of *S. brachiata* are greedily sought and eaten by deer. The *Papeeta* of India, said to be there successfully employed in the treatment of cholera, is the St. Ignatius's bean, (*S. St. Ignatii.*) Giddiness and convulsions are, however, known to follow its exhibition, especially if given in an overdose. In Java,

S. colubrina is much esteemed as a febrifuge; and the bark of *S. pseudo-quina* is considered in Brazil as at least equal to *Cinchona* in the cure of intermittent fevers.

(4606.) *S. potatorum* is the cleansing-nut of Hindustan; and in that vast peninsula, in many parts of which the only water to be procured is that preserved in tanks, and which in general is very impure, it is a most valuable plant. The pulp of the fruit, when ripe, is eaten by the natives, and the seeds are dried and sold in every market, to clear muddy water; a precious quality in a country where the water is rarely of a good quality. One of the seeds, if rubbed hard for a minute or two round the inside of the vessel before the water is put in, the fluid, however foul, will, a short time being allowed for it to settle, be freed from all its impurities, the adventitious matters being precipitated to the bottom, and the supernatant water left clear and perfectly wholesome. These nuts are constantly carried about by the more provident part of our Indian officers and soldiers in time of war, to enable them to purify their water; they are more convenient than alum, and are perhaps more wholesome.

(4607.) The seeds of the *Cerberæ,* and their milky sap, appear to be second to none in their energy as poisons; to this virulence indeed their generic name alludes, for their touch is as surely fatal as the bite of Cerberus was feigned to be. A single seed of *C. Tanghuin*, (*Tanghuina venenifera* of Du Petit-Thouars,) is said to be sufficient to destroy twenty persons. The seeds of *C. Thevetia*, *C. Manghas*, *C. Ahouai*, are all more or less active poisons; and the *Icotli* poison of Mexico is thought to be procured from a species of *Cerbera*. In small doses, the bark and leaves of *C. Manghas* are said to be emetic and purgative; and the bark and sap of *C. Ahouai*, when taken into the stomach, provoke vomiting; but they are also narcotic, and the wood of the plant is sometimes thrown into ponds to stupify or poison fish. The bark of *C. Thevetia* is bitter and cathartic, and it is reputed to be a powerful febrifuge, two grains only being affirmed to be equivalent in effect to the ordinary doses of *Cinchona*, which are thirty or sixty times as great.

(4608.) The *Apocyna* are suspicious plants, some poisonous, but others innocuous. *Apocynum maculatum* and *citrifolium* come under the former category; *A. Indicum* and *Juventus* under the latter. Indeed, Loureiro tells us, that in Cochin-china *A. Juventus* is reputed to have the power of restoring to old age, all the vigour of youth. In India, the leaves of *A. Indicum* are, when boiled, eaten either alone or with fish. The root of *A. cannabinum* is said to be emetic, and in decoction serviceable as a diuretic and diaphoretic; properties which are likewise found to exist in *A. androsæmifolium;* both these species have also been recommended as febrifuges. The latter is remarkable for the irritability of its stamens, which contract with violence on the slightest irritation, such as the insertion of a hair or the proboscis of a fly. It is a not uncommon shrub in our gardens; and I have often seen from 50 to 100 flies imprisoned and slain, and as it were hung in fetters in *terrorem*, by a single plant, during the sunshine of a summer's day.

(4609.) *Caoutchouc* has been found in the milky saps of several of these plants. It exists in a small but notable quantity in the juices of *Apocynum Androsæmifolium, A. Cannabinum, Willughbæa scandens, Vahea gummifera, Urceola elastica,* and others, but more especially in the two last-named, from which it is

procured for commercial purposes in great abundance, the chief of the *caoutchouc* brought from the East Indies being extracted from these plants, which are natives of Sumatra and Madagascar. It might probably be obtained from several species of *Tabernæmontana*, to which genus both *Vahea gummifera* and *Urceola elastica* are referred by Sprengel; as well as from various other more or less common plants; for one of the not least remarkable features in the history of this extraordinary substance (once regarded only as a curiosity, and brought to this country in very small quantities as a rarity,) is, that as uses for it have been devised new sources of it have been discovered; and the more its importance and general applicability in the arts have been established, the more common and abundant it has become. Of its numerous applications this is not the place to treat in detail, but it may be not irrelevant to observe, so great is its present consumption, that several thousand tons of it have been imported during the few early months of the current year, while, five or six years ago, it scarcely formed a noticeable entry in our books of customs; and, half a century back, its existence was scarcely known. The first public mention of *caoutchouc*, or, as it was then called, Indian-rubber, which name it still retains, although it is now but seldom used by artists, is in a note, added by Dr. Priestley to the Preface of his "Treatise on the Theory and Practice of Perspective," dedicated to Sir Joshua Reynolds, and published in 1770. He says, "Since this work was printed off I have seen a substance excellently adapted to the purpose of wiping from paper the marks of a black-lead pencil. It must therefore be of singular use to those who practise drawing. It is sold by Mr. Nairne, mathematical instrument maker, opposite the Royal Exchange. He sells a cubical piece of half an inch for three shillings, and he says it will last several years." Now it is imported by tons, and sells at from 2*d*. to 6*d*. per lb.

(4610.) *Caoutchouc* is a most extraordinary substance, not only in its uses, but also in its chemical composition. It consists solely of carbon and hydrogen, the former in great excess; and, by subjecting it merely to the action of heat, it assumes various different mechanical conditions, and changes its state from a solid to a permanent, and even etherial liquid form, without varying the proportions of its elements. When once solidified from the sap, in which it is suspended or combined, it is scarcely soluble in any ordinary menstrua, except the essential oils and coal naphtha; but the fluid *caoutchucine*, procured by the distillation of solid *caoutchouc*, is one of its most perfect and effectual solvents; thus affording the remarkable paradox of a substance being soluble in itself. The saps in which it is naturally found in a fluid state are no less extraordinary than the *caoutchouc* they contain, for this solid matter exists in them in a fluid state in the proportion of nearly, if not quite one-half of their weight; and yet this sap moves through the delicate vessels of the plants without interruption thus strangely burdened, but not encumbered. No blood of animals, or any other vital fluid, is known to contain such a vast proportion of solid matter.

(4611.) Other species, truly belonging to the genus *Tabernæmontana*, are remarkable for their lactescence; such as *T. arcuata*, and a newly described one, called by Mr. Arnot *T. utilis*. This latter would appear to be the *Hya-hya*, or milk-tree of Demerara; and, according to the account of Mr. Smith, its European discoverer, it yields, when wounded, a copious stream of a thick, rich, milky fluid, quite bland and wholesome, but leaving, after being drank, a slight clamminess

upon the lips. So abundant is this milky sap, that the waters of a small stream, on the banks of which a tree had been felled, became completely whitened in an hour or two. This liquid, however, as might have been anticipated, from the natural affinities of the plant that yields it, owes its lactescence not to oil, but to the presence of *caoutchouc*, or of a substance nearly similar to it, as chemical analysis has satisfactorily shewn. It will therefore most likely be inapplicable to dietetic purposes, as *caoutchouc* is innutritious. The cream-tree of Sierra Leone is said to belong to this group, but to which genus is as yet unknown: and from the *Voacanga* of Madagascar bird-lime is procured.

(4612.) *Cameraria latifolia* is another example of the deadly influence of these lactescent plants. Its juice is so poisonous, that it is used in the West Indies by the natives to envenom their arrows; the flesh, however, of the beasts thus killed is not rendered unwholesome as food. The *Vinca major*, and the other species of periwinkle, are astringent; they contain gallic acid, and turn solutions of iron of a dense black: they have been recommended as vulneraries, but are not now employed. *V. minor* was the favorite flower of Jean Jacques Rousseau.

(4613.) The *Vincæ* or *Periwinkles*, and *Neria* or *Oleanders*, so much valued for their beauty, are exceptions to the general rule of the order to which they belong, as their juices are not milky. They are not, however, the less acrid for their non-lactescence. *N. Oleander* contains an abundance of gallic acid; and a decoction of its leaves, or bark, forms an acrid stimulating wash, much employed by the poor people in the south of France to cure the itch, and to destroy cutaneous vermin. The peasants in the neighbourhood of Nice use the powdered bark and wood of the *oleander* to poison rats: several cases are also on record, in which death has been caused by eating meat which has been roasted on a spit of *oleander* wood. And Libantius tells us of an individual who was found dead after sleeping in a room where an *oleander* plant was in full blossom: and who, he says, "died from allowing the shrub to remain in his chamber during the night." It is probable, however, at least in the latter case, that death was a coincidence rather than a consequence, for the flowers of the *oleander* are scentless; and in that of two French soldiers, above alluded to, both of whom were poisoned by meat roasted on an oleander rod, that the portions of meat which proved such deadly food were those in immediate contact with the spit; for the flesh of animals slain by poisoned arrows is not injurious, if the wounded parts be excised and thrown away.

(4614.) *Ophioxylon serpentinum* is one of the snake-woods, which in various parts of India are affirmed to be antidotes to the bites of poisonous reptiles. *O. spinosum* is bitter; and, according to Ainslie, it is esteemed as a tonic in Java. The *Alyxiæ* are also bitter as well as aromatic. The bark of *A. aromatica* and *A. Reinwardii* have the odor of *Melilot*, and traces of benzoic acid have been found in the latter; they are both used as tonics, and are said to resemble *Canella* in their effects.

(4615.) *Wrightia* (olim *Nerium*) *tinctoria* affords a valuable blue dye, equal, it is said, to indigo. *W. antidysenterica* is the *Pala patta* of Malabar, there much esteemed as a tonic and febrifuge, and thought to be very serviceable in the treatment of dysentery; it is sometimes known under the name of *Malabar bark*: it is very bitter, and, when fresh, lactescent, the milky juices being employed on the Coromandel Coast as a vulnerary. The bark of *Echites antidysenterica* is astrin-

gent and febrifugal, as well as that of *E. scholaris*. *E. syphilitica* is used in decoction as a restorative in cachectic disorders; and the seeds of *E. torulosa* are said to be taken by the negroes both as emetics and purgatives. It is also said to be with the sap of an African *Echites* called *Ko-na* that the natives on the Western coast poison their arrows.

(4616.) *Allamanda cathartica*, a native of Ceylon and Java, is a violent emetic and purgative. When however exhibited in moderate doses, an infusion of its leaves is affirmed to be a very useful medicine, and especially serviceable in the cure of painter's colic. *Plumiera alba* and *rubra* have esculent fruits, which in the West Indies were called *Franchipanes* by the French settlers; their sap is, however, acrid and purgative, and has been used, as well as the *P. drastica* and *P. phagedenica*, and the root of *P. obtusa*, as powerful cathartics.

The *Plumieriæ*, which are somewhat succulent, anticipate, in this particular, the fleshy leaves and stems frequent among the *Stapelidæ*.

(4617.) The fruits of the *Carissæ* are also eatable, as well as their leaves; the berries of *C. Carandas* are in general either pickled when unripe, or, when ripe, eaten with salt, or preserved in sugar. The young shoots and leaves of *C. edulis* are boiled or eaten as potherbs in Nubia and Arabia; and its fruit is also there esteemed. The wood of *C. Xylopicron*, which, as its name imports, is very bitter, is sometimes made into medicinal cups, for the wine poured into such a vessel acquires some of its bitterness, and is then believed to become stomachic. The berries of *Arduina bispinosa* (olim *Carissa Arduina*) are also esculent. But some doubt has been entertained as to whether these two last-named genera rightly belong to the present type.

(4618.) STAPELIDÆ, or *Asclepiadeæ*. These, like their associates in the preceding subtype, are mostly suspicious plants; acrid, but on the whole less poisonous than the *Apocynidæ*. The most important genera are perhaps the following: *Periploca*, *Stapelia*, *Pergularia*, *Cynanchum*, *Asclepias*, *Calotropis*, and *Gymnema*; to which may be added, *Dischidia* and *Hoya*, as curious and interesting.

(4619.) The *Periplocæ*, by their pulverulent pollen, corroborate the connexion between the *Stapelidæ* and *Apocynidæ*, established previously by other characters.

(4620.) *Periploca Græca* is a poisonous plant; its leaves are fatal both to dogs and wolves, and hence would probably, if taken, be equally fatal to man. Nevertheless they have been found serviceable as resolutive cataplasms. *Periploca Mauritania* is said to yield a concrescible resin, which has brisk cathartic powers. It is collected for medicinal use, and known in commerce as Smyrna scammony. This resin is, however, said by some persons to be the exudation of *P. Secamone*, now called *Secamone Ægyptiaca*; and another species, *S. emetica*, is known to have emetic powers. A decoction of the root of *P. sylvestris* will likewise produce vomiting; and Ainslie tells us that the roots of *Periploca Indica*, which have an external similitude to those of the Smilax Sarsaparilla, also resemble them in their medicinal virtues. *P. esculenta*, a native of Malabar, is said to be eatable, but the statement requires confirmation; *Pergularia edulis* is likewise affirmed to be a wholesome dietetic vegetable.

(4621.) The *Stapeliæ* are very curious plants, with succulent stems, and devoid of leaves, thus resembling some of the *Cacti* and *Euphorbiæ*. Their blossoms are often extremely fœtid, whence their vulgar name of *carrion flowers*. They are chiefly natives of the sandy plains of Africa; some, as *S. pilifera*, *S. arti-*

culata, &c. are eaten by the Hottentots; and also, when pickled, by the Dutch settlers at the Cape.

(4622.) *Cynanchum*, as the name implies, is a genus including deleterious plants, especially canine poisons, or dog-banes. *C. erectum*, when given to a dog in the dose of 36 grains, produced violent vomiting, universal tremors, and death. The other species are, however, less deleterious; one, the *Cynanchum Vincetoxicum*, was formerly believed to be an antidote to all kinds of poisons; and others, such as *C. Arghuel*, are merely drastic cathartics. The leaves of this latter are largely used to adulterate senna; indeed, they form the bulk of many samples. C. *Monspeliacum* affords the Montpellier scammony. The roots of *C. tomentosum* are employed in the Isle of France as an emetic; and those of *C. vomitorium*, or *Ipecacuanha*, now arranged amongst the *Asclepiades*, are known in medicine as false ipecacuan, and sometimes used as a substitute for the genuine drug.

(4623.) *Asclepias asthmatica* is the modern synonyme of the plant just mentioned. It is, like other nauseating medicines, valuable as a sudorific, and said to be peculiarly beneficial in humoral asthma. Its young shoots are eaten after the manner of asparagus, and form a very grateful dietetic vegetable. The buds of *A. stipitacea* are in like manner eaten by the shepherds in Arabia; *A. aphylla* is also edible. The roots of *A. Curassavica* and *A. prolifera* are emetic and purgative; and that of *A. tuberosa* is famed as a diaphoretic. It is affirmed to have the power of exciting a general perspiration, without increasing in any perceptible degree the heat of the body. In Virginia it is used as a remedy both in pleurisy and dysentery. *A. decumbens*, sometimes considered as a distinct species, has similar properties to the foregoing, of which it is probably only a variety.

(4624.) *A. gigantea* is perhaps one of the most poisonous of the whole; it is a native of India, and it is said to kill even oxen when they eat it. It is bitter and antispasmodic, and an infusion of its root, which is also emetic, has been found serviceable in typhus fever.

(4625.) The milky sap of the *Asclepiades* is in general acrid; that of *A. laniflora*, when mollified by admixture with lard or butter, is made into an irritating ointment to cure the itch; and the lactescent juice of *A. procera* is so corrosive, that it is employed as a depilatory, and even to remove the hair from hides that are to be made into leather; while, on the other hand, the milk of *A. lactifera*, which it yields in abundance, is sweet and wholesome, and the Indians drink it as we do that of goats and cows. Indeed, the cow-plant of Ceylon is a nearly allied species; it is called *Gymnema lactiferum*, and its sap is used by the Cingalese for alimentary purposes; its leaves are also esculent when boiled.

(4626.) The sap of *A. Syriaca* contains a notable quantity of caoutchouc, of which that of its allies is most probably not devoid, although it may be present in them in a less proportion. This plant has been recommended as an expectorant, and at one time it was proposed to spin and weave the silky investments of its seeds; the down is, however, more fit to stuff mattresses and pillows. The seeds of *A. spiralis*, which are sweet, are esteemed in Arabia as a carminative, and administered to relieve griping pain in the bowels.

(4627.) *Calotropis Mudaria* (*gigantea?*) is the akund, yercum, or mudar plant of India, where it is much esteemed as a purgative and emetic, but more especially as an alterative; and in *leprosy* and *elephantiasis*, and various cachectic

diseases, it would appear to have been of signal benefit. It contains a peculiar proximate principle, which has been called *Mudarine.* This substance has no smell, but is intensely bitter, with a very peculiar nauseating taste; but its more remarkable characteristic is its exceeding solubility in cold water, *i. e.* in water of the ordinary atmospheric temperature, and its insolubility in boiling water. This, however, is not a solitary exception, though a very marked one, to the general rule, that the solvent powers of *menstrua* are increased by an increase of temperature.

(4628.) *Diplolepis vomitoria* of Rœmer and Schultz is a Chinese plant belonging to this order, and having emetic properties; but its generic name is untenable, it being appropriated by entomologists. Geoffroy long since coined the word *Diplolepis,* and gave it to a group of insects, a subdivision of the Linnean genus Cynips.

(4629.) The *Hoyæ* are curious plants, having flowers so waxy and formal in their appearance, that they suggest the idea of nature having for once taken a lesson from art. They have a very honey-like scent; and it is said to be a good plan to have one or two in a vinery, as, when in flower, they attract the wasps, and thus protect the grapes.

(4630.) *Dischidia Rafflesiana* is one of the pitcher-plants, its *vascula* being formed by the union of the edges of the leaves.

(4631.) Loganiaceæ. *Logania, Potalia,* and their respective allies, are trees and shrubs, rarely herbs, with non-lactescent juices, opposite simple entire leaves, with interpetiolar stipules, often connate, forming a sheath, seldom free and lateral, very rarely absent (as in some species of *Logania.*)

The inflorescence is axillary or terminal, solitary or aggregate; when the latter, racemose or paniculate, and the flowers mostly regular and united.

The calyx is free, persistent, 5- (more rarely 4-6-) cleft; the corolla hypogynous, deciduous, synpetalous, with a 4-5-cleft limb; the lobes alternate with the sepals, and sometimes bifid, and convolute in æstivation. The stamens are epipetalous, equal in number to the lobes of the corolla (seldom fewer), and exserted alternately with them, all on the same level; the filaments are free, the anthers 2-celled, the pollen pulverulent, simple, and elliptical, or with 3 bands; the germen is formed of 2 connate carpels, 2-celled, or by secondary septa, 4-celled, the placentæ are central; the style continuous, and the stigma simple.

The fruit is capsular or baccate, 2-4-celled, or drupaceous, with 1-2-seeded stones; the seeds are definite or indefinite, peltate, testa double, or finely reticulated; the albumen fleshy, cartilaginous, or horny; the embryo included, not foliaceous; in the one subtype (*Loganidæ*) erect, in the other (*Potalidæ*) supposed to be inverted.

(4632.) Hence, differentially considered, the *Loganiaceæ* are non-lactescent *Gentianinæ,* with opposite, mostly stipulate leaves, convolute æstivation of the corolla, pulverulent pollen, simple stigmata, peltate seeds, with cartilaginous albumen, and non-foliaceous embryo.

(4633.) The *Potalidæ* have a contorto-convolute æstivation, the corolla unequal in the number of its segments with the calyx; simple, elliptical pollen; a succulent fruit, 4-lobed placenta, numerous sessile seeds with double coats, horny albumen, and an inverted embryo.

(4634.) The *Loganidæ* have a simply convolute æstivation, 3-ribbed pollen, the fruit capsular or drupaceous, the seeds with a finely reticulated integument, fleshy or cartilaginous albumen, and the embryo erect.

(4635.) *Potalia* and its allies are very similar to some of the *Apocynidæ*, especially *Strychnos;* but they differ in the intrafoliaceous stipules, aqueous juices, discordance between the number of segments in the calyx and the corolla, the peltate seeds, horny albumen, and non-foliaceous embryo; and hence they are properly segregated, and made the connecting link between them and the *Loganidæ*, which in their turn very closely approach the *Gentianaceæ*. The general properties of the type have scarcely been yet made out. Of the *Loganidæ* there is nothing certain known; and the *Potalidæ* seem to partake of those of both the associated types, for *P. amara* is bitter, like the *Gentianaceæ*, and acrid and emetic, like the *Strychnaceæ*, but not poisonous. In Guiana it is used as a vomit, when deleterious effects ensue from eating manihot not sufficiently prepared. A resin is procured from its young branches, which has the odor of *benzoin*. Its leaves are also administered in certain cachectic disorders; and an infusion of those of *P. resinifera*, which are mucilaginous and astringent, is said by Von Martius to be used in the province of Rio Negro, in Brazil, as a collyrium in ophthalmia.

PRIMULINÆ.

(4636.) The Primrose and the Olive, with their respective allies, form the two types or natural families contained in this section, which, from *Primula*, may be called the PRIMULINÆ. Other groups are distinguishable, and have been distinguished by various writers as separate orders, but these, of which *Myrsine*, *Jasminum*, and *Columella*, are the normal genera, seem to differ too little in their structure to demand more than a subtypical segregation.

(4637.) Collectively considered, the *Primulinæ* are hypocorollous or hypogynous *Syringales*, (the petals being very rarely absent,) *i. e. Primulosæ*, with aqueous sap, opposite, simple (seldom pinnate) exstipulate leaves, uncrowded or non-congested inflorescence, regular but unsymmetrical flowers, the stamens being either less in number than the petals, or opposite to them in their exsertion. The fruit and embryo variable.

(4638.) OLEACEÆ. The olive, and its typical allies, are trees or shrubs, with aqueous juices, erect or scandent stems, often 4-cornered branches and compressed nodes. Their leaves are opposite, petiolate, simple (seldom ternate or imparipinnate), and destitute of stipules.

The inflorescence is paniculate or in trichotomous panicles, and the flowers regular and united, or sometimes by abortion polygamous.

The calyx is free, herbaceous and persistent, synsepalous, with a definitely (seldom 4-5) cleft limb, which is sometimes obsolete. Disk absent, corolla hypogynous, deciduous (rarely wanting, as in *Fraxinus*), synpetalous, 4-5- (seldom 6-8) cleft, the petals occasionally remaining discrete (as in *Ornus*), and valvate or imbricato-contorted in æstivation. The stamina, 2 in number, are hypogynous when the corolla is absent, epipetalous when it is present, being exserted from its tube, alternate with its lateral lobes, or when tetrapetalous connecting the lateral petals in pairs. The filaments are free, the anthers 2-celled, incumbent, with apposite parallel locules, dehiscent laterally or introrsely by longitudinal clefts;

the pollen is pulverulent, the germen formed of 2 connate carpels, 2-celled, the cells 1-2-ovuled, the style 1 or 0, the stigma often bifid, sometimes undivided.

The fruit is drupaceous, baccate, or capsular, rarely samaræform, 2-celled, 2-4-seeded, sometimes by abortion 1-celled and 1-seeded. The seeds erect or pendulous, exarillate, and with naked testæ. The albumen fleshy or horny, sometimes

B. *Ornus Europæa.*

Branch, to shew compound leaves and inflorescence.

(*a*) A flower separate, to shew its four discrete petals and two stamens.

(*b*) The samaroid fruit.

C. *Olea Europea.*

Branch with leaves and fruit.

(*a*) Twig with flowers.

(*b*) Single flower, to shew the two stamens and pistil, &c.

(*c*) The calyx and pistil, the corolla being removed.

(*d*) Section of ditto, to shew 2-celled ovary and pendent ovules.

(*e*) The fruit.

(*f*) The embryo,

very spare. The embryo straight, the radicle superior or inferior, the plumula inconspicuous, and the cotyledons foliaceous in germination.

(4639.) Hence, differentially considered, the *Oleaceæ* are diandrous *Primulinæ*, with syn- (seldom a- or apo-) petalous flowers, and 2 connate carpels, becoming a 1- or 2-celled fruit.

(4640.) The genera here associated are distributable into two subtypes, the *Fraxinidæ* and *Jasminidæ;* and to these a third may be added, viz. the *Columellidæ;* for although, as will be seen by their definition, they are non-conforming *Oleaceæ*, their relation seems more intimate with the *Jasminidæ* than with any other group, and hence, at least for the present, these plants, of which there is very little known, may be located here.

(4641.) The *Columellidæ* differ from the normal *Oleaceæ*, especially from the *Jasminidæ*, their nearest allies, in the following particulars: they have solitary flowers, the calyx adherent to the germen, the limb superior and many-toothed, the corolla convolute in æstivation, the disk present and perigynous, the anthers sometimes sinous, the stigma capitate and undivided, and the fruit always capsular, with many seeds, and fleshy albumen.

(4642.) In the *Jasminidæ* the calyx is free, the corolla contorto-imbricate in æstivation, the disk absent, the stigma 2-lobed, the fruit capsular or baccate, and the seeds solitary, erect, and with little or no albumen.

(4643.) In the *Fraxinidæ* the calyx is free, the corolla, when present, valvate

in æstivation, the disk absent, the stigma bifid or simple, the fruit 2- or 1-seeded, the seeds pendulous, and the albumen fleshy and abundant.

(4644.) *Columellidæ.* *Columella* and *Menodora,* which Don has associated to form this group, afford another example of the incompatibility of natural and artificial schemes of arrangement, and of the folly, the more than folly—the prejudice,—which, notwithstanding the accumulation of evidence, would confine attention to one scheme alone: and forbidding the use of the Linnean index, torture the system of affinities, and render its definitions paradoxes, in order imperfectly to do its handmaiden's duty. The perigynous corolla and inferior fruit of the *Columellidæ* would differentially indicate their station to be amongst the pericorollous *Ericosæ,* for the superior germen of the *Primulosæ,* although a very general, is not an absolute or essential character; and, excepting this adhesion of the calyx to the germen, which may be considered as merely an extension of the half-inferior ovarium of *Samolus* amongst the *Primulaceæ,* their connexions are evidently the strongest with the *Jasminidæ;* for they agree with them not only in the particulars already noted, but also in their yellow flowers, almost in the æstivation of the corolla, and in the dehiscence of their capsular fruit, (which, like that of the syringa, is incompletely septicidal,) and probably also in their ovules being erect. They are natives of Peru and Mexico, but of their properties and qualities there is nothing at present known.

(4645.) *Jasminidæ.* These are elegant, and often very fragrant shrubs. From their flowers some of the most delicious perfumes are extracted, such as the essential oil of jasmin, which is distilled from the flowers of *J. grandiflorum, officinale,* aud *odoratissimum,* as well as from the *Jasminum,* or, as it is now called, *Mogorium Sambac,* which is the *Yasmyn* of the Arabs, whence our common European name. The flowers of *M. undulatum* and *trifoliatum* are also sweet-scented, and their leaves, which have a bitter taste, have been recommended as slightly stomachic, and agreeable cephalic medicines. The powdered root of *Jasminum angustifolium* is extremely bitter, and it is said by Ainslie to be an effectual application to ringworms. *Nyctanthes arbor tristis* has likewise a very fragrant blossom, and to its expanding only towards night, and diffusing its odors chiefly during the dark, its generic and specific names allude. The bark and root of this plant in decoction have been recommended as expectorants, and the tube of its corolla is said to afford a colouring matter, which in India is used by the dyers.

(4646.) *Fraxinidæ.* This subtype has by some authorities been divided into two or three separate orders, which, however, if distinguished at all, can only be regarded as subtypical districts; in one of these, which may be called the *Syringeæ* (*Lilaceæ* of Ventenat), the leaves are simple, and the fruit is dry and capsular.

(4647.) In the second, the *Fraxineæ,* containing *Fraxinus* and *Ornus* only, the leaves are compound, imparipinnate, the corolla none or apopetalous, and the fruit a samara;

(4648.) While in the third, the *Ligustreæ,* the leaves are simple, and the fruit is drupaceous or baccate.

(4649.) This, like the preceding subtype, contains many ornamental shrubs, several of which have fragrant flowers. The Lilac (*Syringa*), the Privet (*Ligustrum*), the Olive (*Olea*), and the Ash (*Fraxinus*), are the best known and most important genera. De Candolle observes, in confirmation of the natural affinities of the apparently heterogeneous assemblage compressed in the three districts of

this subtype, that all the species of the various genera will graft on one another; a remarkable fact, and demonstrative of the similitude of their vascular structure, and the sameness of their sap. It is well known that the lilac will graft upon the ash, and the olive on the *Phillyrea*, (which two genera are even by some botanists united): but to these he adds the instances of the olive taking on the ash, of the ash on stocks of *Chionanthus* and *Fontenesia*, and says that he has succeeded in making the Persian lilac live ten years on *Phillyrea latifolia*, while the jasmines cannot be grafted on the olive, or on any of the *Fraxinidæ*.

(4652.) The privets (*Ligustra*), like the periwinkles (*Vincæ*), and some comparatively few other plants, will flourish under the shade and drip of trees; they are also very tolerant of smoke, and hence are common even in the closer parts of London. Their twigs are very flexible, and are used as rural ligatures; hence indeed, it is said, they have received their generic name. The leaves are bitter and astringent, and have been employed as detergents and styptics. The berries are innocuous, and are fed on by partridges and other birds. They have also been employed by the Dutch to mix with those of the buckthorn. A kind of vegetable wax is excreted from *L. lucidum*, which is said to be used for economical purposes in China.

(4653.) The *Phillyreæ* are likewise ornamental evergreen shrubs, their berries affording food for birds, but not for man; their leaves and bark are astringent, and in decoction, or steeped in vinegar, have been used as gargles. Those of *P. latifolia* are said to be serviceable as a diuretic.

(4654.) *Olea* (in which genus the *Phillyreæ* are by some included,) contains one most important species, viz. THE *Olive* [*O. Europæa*,] the fruit of which abounds in a bland fixed oil. This oil is expressed from the fleshy pericarp, the olive being one of the several yet few exceptions to the general rule, of fixed oils being obtained from seeds alone. The olive grows freely in the south of Europe; and, although it does occasionally bear fruit in this country, the crops would be too scanty and uncertain to allow an extensive cultivation. Our chief supplies of olive-oil are derived from Italy, especially from Florence and Lucca, but that from Provence is of a superior quality. In Spain and Italy this oil supersedes the use of butter, hence its consumption in those countries is far greater than amongst us, our annual imports averaging only a little more than two million gallons.

(4655.) Besides the oil, the unripe fruit of the olive is pickled and eaten on the Continent to provoke an appetite; here olives are generally taken after dinner, in order to remove the taste of the viands or dessert from the mouth, so that the flavor of the wine may be the more enjoyed.

(4656.) The wood of the olive is beautifully veined, has an agreeable smell, and takes a fine polish; it is therefore much esteemed for cabinet and ornamental work. The bark of the olive is bitter, and has been recommended as a febrifuge. A resinous exudation is found on the old wild olives, which has been used as an astringent; it contains a peculiar proximate principle called *Olivine*.

(4657.) *Olea fragrans* (the *Osmanthus* of Loureiro,) has very sweet-smelling leaves and flowers. It is called *Lan-hoa* by the Chinese, who use the foliage and blossoms to perfume their teas, and at the same time to increase their bulk.

(4658.) If the oak is the noblest, the ash is the most elegant of our native trees; if the one is the king, the other is the queen of our forests. Its graceful port and the light airiness of its foliage are proverbial; and well was it termed

by Virgil "*Pulcherrima sylvis.*" The ash is not only beautiful but useful; it yields a valuable timber, much in request by wheelwrights, and for the manufacture of instruments for husbandry. Its bark is bitter, and has been used as a febrifuge; and its leaves, which have a similar flavor, have been frequently employed to adulterate tea. Willich indeed says that, as a tonic, they are superior to the China drug. They are also said to be decidedly cathartic, but less so than those of senna, and to have an unequivocal action on the kidnies. Pliny tells us that the ash is obnoxious to serpents, and branches are often hung about children's beds to keep off the gnats.

(4659.) *Ornus Europæa* is the manna-ash, generically distinguished from Fraxinus by its tetrapetalous corolla. This and other species, such as *O. rotundifolia, floribunda,* &c. yield that peculiar saccharine cathartic known in medicine under the name of manna. The saccharine matter it contains is essentially different from common sugar, for it will not ferment with water and yeast; hence it is considered a peculiar principle, and called Mannite. Manna is chiefly brought to us from Calabria, where the trees are common and the exudations abundant. A similar substance is said to be secreted by some species of ash, which may account for the purgative powers of their leaves.

(4660.) Primulaceæ. The Primrose type includes herbaceous, shrubby, and arborescent plants, with often round, rarely tetragonal stems; alternate, (seldom opposite or whorled,) simple leaves without stipules.

The inflorescence is terminal or axillary, solitary or sociate, racemose, paniculate or sertulate, not capitate or densely aggregate, and the flowers are for the most part regular and united, seldom polygamous.

The calyx is free, herbaceous, persistent, synsepalous, 5- (rarely 4-6-7) cleft, and the lobes imbricate in æstivation. The torus not dilated. The corolla is hypogynous, deciduous or marcescent, synpetalous, (the segments rarely discrete, and when so, with broad ungues,) the lobes equal in number to the segment of the calyx, and alternate with them, the stamina epipetalous, or (when the corolla is absent, as in Glaux,) hypogynous, equal in number to the lobes of the calyx or corolla, opposite in the latter, alternate with the former. The filaments are free or monadelphous, sometimes wanting, and sometimes with a series of barren ones alternating with those that are fertile. The anthers are innate, mostly erect, sometimes incumbent, 2-celled, with parallel continuous locules, and dehiscent lengthwise by chinks. The germen is regular, unilocular, with a free central placentiferous column, which is sometimes shortened, the ovules indefinite, rarely definite, and peltate, the style 1, sometimes short, and the stigma undivided or lobed.

The fruit is capsular, the valves equal in number to the lobes of the calyx, and dehiscent by valves, rarely circumscissile, sometimes fleshy, and indehiscent. The seeds definite or indefinite, sometimes by abortion solitary, albumen fleshy or corneous, of the same shape as the seed, the embryo included, and lying across the hilum.

(4661.) Hence, differentially considered, the *Primulaceæ* are oligandrous *Primulinæ*, the stamens more than two, opposite the lobes of the corolla, and equal to them in number, a 1-celled fruit, with free central placentæ, albuminous seeds, and a transverse radicle.

(4662.) *Myrsine* and *Primula* give their names to two subtypes, often con-

sidered as separate orders, but which are here associated, as their chief structural difference lies in their herbaceous or arborescent port;

(4663.) The *Myrsinidæ* are arboreous or shrubby *Primulaceæ*, with indehiscent fleshy fruit, and the ovules immersed in a fleshy placentæ;

(4664.) The *Primulidæ* are herbaceous ones, with the fruit capsular, rarely becoming at all fleshy.

(4665.) *Myrsinidæ*. *Myrsine*, one of the old Greek names of the myrtle, has been given to a genus of handsome shrubs with myrtle-like leaves, but possessed of no very remarkable properties. The *Ardisiæ*, their immediate allies, are also prized for the beauty of their foliage; and one species, *A. humilis*, the *Badulam* of Ceylon, is there made into a syrup, and taken to moderate the heat and thirst of ardent fevers. The *Jacquiniæ* are also very ornamental plants; and one of them, *J. armillaris*, so beautiful, that its twigs form favorite garlands with the American females; but *Theophrasta Jussiæi* is a humble prickly-leaved shrub, which, although something curious, is little worthy the honour of bearing so great a name. In St. Domingo it is called *Coco* by the negroes, and by the French colonists "*Le petit coco*." Its seeds are eatable, and bread is made of them.

(4666.) In *Mæsa* or *Bæobotrys* the calyx adheres to the germen, as it also does in *Samolus*, of the following type, by some authorities placed here, and considered, with *Mæsa*, as forming a district of the *Myrsinidæ*, called *Samoleæ*. *Embesa* is also an aberrant genus, for, as in *Ornus*, the segments of its corolla are discrete, so that its flowers are apopetalous.

(4667.) *Primulidæ*. These plants, the *Preciæ* of Linneus, the heralds or

A

A. *Primula Veris*. Entire plant.

(*a*) Calyx and pistil.

(*b*) Corolla opened, to shew stamens and pistil.

(*c*) Back view of the corolla.

(*d*) Fruit.

(*e*) Longitudinal section of the same.

harbingers of spring, are no less prized and estimable for their intrinsic beauty, than endeared by their early advent. The modest primrose, cowslip, and auricula,

are the welcome forerunners of the beautiful loosestrife, marsh-violet, and pimpernel, the lovely cyclamen, the *Soldanella,* and the incomparable *Dodecatheon,* worthy indeed of its dedication to twelve divinities.

(4668.) The properties of these plants are insignificant, nature having thus as it were secured some of her prettiest flowers from rapine, and spared us kindly the pain of destroying these most delicate specimens of her handiwork. Swine, who never look up to the tree from whence falls their food, nor lick the hand that feeds them, are the only animals which claim any of the *Preciæ* for their especial sustenance. The rootstake of the *Cyclamen,* which abounds in Sicily, is fleshy and very acrid, but, notwithstanding this, it is the chief aliment of the wild boars of that island, and hence its common name of sow-bread. It has been used medicinally: its action is that of a drastic purgative, and formerly it was much esteemed as an emmenagogue, but whether its reputation was owing to its actual powers, or to its placentiform rhizoma, is doubtful. Its acrid principle has been considered to be a body *sui generis,* and named arthanitine.

(4669.) *Trientalis Europæa,* the winter-green, is the only British plant belonging to the Linnean artificial class Heptandria. It is slightly acrid, like most of the Primulæ. *P. veris,* the cowslip, is also reputed to possess a mild narcotic power, and hence it is used to flavor and heighten the intoxicating effects of fermented liquors, cowslip wine being a favorite provincial drink. And *Dodecatheon,* notwithstanding its beauty, is as devoid of power as the dozen demigods to whom it has been devoted.

(4670.) *Samolus,* one species of which, *S. Valerandi,* was formerly used in the mystic ceremonies of the Druids, and has since been considered a specific in all diseases affecting swine, is a doubtful citizen of this group; not only is its germen, half-inferior, but it has barren filaments, alternating with the fertile ones, as in the *Myrsinidæ,* with which by Bartling it is associated. *Glaux maritima,* the black salt-wort, is in a similar predicament. *Glaux* is usually classed with the *Primulidæ,* but it has been removed by Don to the *Plantaginaceæ;* it evidently forms the connecting link between these two contiguous series. It is chiefly remarkable for its apetalous flowers, the abortion of the corolla being very rare among synpetalous plants; and the few instances in which it occurs are found in the present section, *Glaux* being one, and *Fraxinus* the other; and, with regard to this latter, it is curious to observe, that, previous to the petals becoming altogether abortive, the corolla is changed, as in *Ornus,* from a synpetalous to an apopetalous condition, a state in which, as will be evident on reference to the Rosales, the corolla is much more frequently aborted. This separation would therefore seem to be a retrogression, a preparatory step to a further degradation; and, if so, it would appear to support the belief that this series should conclude the linear arrangement of the dichlamydeous *Exogenæ,* and that in all such successive schemes the apopetalous *Rosales* should come between the apetalous *Querneales* and synpetalous *Syringales.*

PLANTAGINÆ.

(4671.) This, the last section of the suborder *Primulosæ,* comprehends three types, which, from their normal genera, *Plantago, Armeria,* and *Globularia,* are called the *Plantaginaceæ, Armeriaceæ,* and *Globulariaceæ.* This series is intimately connected with the *Primulinæ* through *Glaux,* and not less closely re-

lated to the aggregate *Rubiacinæ* and *Asterinæ* by their mode of inflorescence; thus approximating, as in other orders, the two extremities of the series.

(4672.) Collectively considered, the *Plantaginæ* are herbaceous or suffrutescent *Primulosæ*, with non-lactescent juices, opposite or crowded, rarely alternate, simple, and exstipulate leaves; aggregate, often densely spicate or paniculate inflorescence, the calyx persistent, the germen free and 1-celled, the seeds albuminous, and the embryo straight and axile.

(4673.) PLANTAGINACEÆ. *Plantago* and *Littorella*, which together form this small type, are herbaceous plants, with in general abortive axes, hence mostly without stems, and sometimes with premorse roots; the leaves usually radical and crowded; when the stem is developed, opposite or alternate; simple, flat, and ribbed or taper, and fleshy, exstipulate and marcescent, and the hairs simple and articulated.

In the *Plantagines* the inflorescence is spicate or glomate, in *Littorella* solitary; the peduncles long and scapiform, and the flowers regular and united, seldom separate, sessile, and furnished with bracteolæ, scarious at the edges, and persistent.

The calyx is free, 4-parted, persistent, the segments slightly unequal, scarious at their edges, and imbricate in æstivation; the corolla hypogynous, synpetalous, persistent, with a 4-parted regular limb, the lobes alternate with the segments of the calyx, and imbricate in æstivation. (In the stamineous flowers the corolla is tubular, in the pistilline ones urceolate, with an obsolete limb; and in these latter 3 bracteæ supply the place of a calyx.) The disk is absent; the stamens definite (4), equal in number to the lobes of the corolla, and hypogynous, or exserted from its tube alternate to its segments. The filaments are long, extruded, capillary, flaccid, and induplicate in æstivation; the anthers are versatile, 2-celled, the locules parallel and contiguous, distinct at the base, and dehiscent lengthwise by chinks; the pollen roundish and smooth; the germen is free, sessile, 1-celled; with a central, compressed, 2- (rarely 4-) winged placenta, by which it is made bi- or- quadrilocular. The ovules definite (1-2), seldom indefinite; the style 1, terminal, capillary; the stigma hispid, undivided, rarely bifid.

The fruit is a *pyxidium*, or a membranous capsule, dehiscing transversely; the seeds are sessile, peltate, or erect, solitary or in pairs, seldom indefinite; the testa mucilaginous; the albumen fleshy and conformable; the embryo cylindrical, straight, and axile; the radicle inferior, and the plumula inconspicuous.

(4674.) Hence, differentially considered, the *Plantaginaceæ* are tetrandrous *Plantaginæ*, with a regular scarious corolla, induplicate, flaccid, extruded stamens, alternating with the lobes of the corolla, a simple filiform style, a membranous capsule, dehiscent transversely, and erect or peltate seeds, with fleshy albumen.

(4675.) The *Plantains* are in general regarded as troublesome weeds: their leaves are eaten by some animals, but they contain very little nutriment; and, although the growth of *P. lanceolata* was once encouraged as an agricultural plant, it was found unprofitable, and has long since ceased to be sown. *P. major* is the *way-bred* (not way-bread), so called from its prevalence on the wayside, seeming as if bred on the road. This plant has a peculiar tendency to follow the migrations of man, as if domesticated or sympathetically attached to the human race. Thus, although not purposely conveyed, it has followed our colonists to every part of the world, and has amongst the natives in some of our settlements

been emphatically named "The Englishman's Foot;" for, with a strange degree of certainty, wherever it is found there our countrymen have trod. *P. Coronopus* has been eaten as a salad, but it is too bitter and astringent to be palatable; and these properties, which are perhaps more subdued in it than most of the other species, has recommended some of them as expectorants and vulneraries. Strange tales once were told of their sanative powers, and of which the boast, *consumption curable by plantain*, may serve to exemplify the style. The leaves and roots of *P. media, Holostea*, &c. have been used in decoction as astringent lotions; and the seeds of *P. Psyllium, arenaria*, and *Cynops*, which are peculiarly mucilaginous, have been made into demulcent drinks, and form a good substitute for linseed and marsh-mallows. The seeds of the other common species are a favorite food with small birds.

The besom plantain is a curious variety of *P. major*, in which the bracteolæ become inordinately developed and imbricate; and the rose-plantain is another variety, in which they become whorled at the end of the scape, and expand so as to resemble a rose.

(4676.) ARMERIACEÆ. The *Thrift* (Armeria), and the *Lead-wort* (Plumbago), with their allies, are herbaceous plants, with shortened stems, or suffrutescent, rarely shrubs. Their leaves are alternate or clustered, simple, somewhat sheathing at the base, but exstipulate, and marcescent.

The inflorescence is aggregate, glomerulate, subcapitulate or spicate, seldom paniculate; the peduncles often scapiform; the flowers regular and united, and furnished with 3 bracteolæ, which are frequently scarious.

The calyx is free, tubular, and persistent, scarious or coloured; equal, 5-plaited and 5-toothed; the torus is undeveloped; the corolla syn- or apo-petalous, hypogynous, equal, with a 5-parted limb, the lobes 1-nerved, and the tube 5-angled, or the petals 5, and discrete; the æstivation is contorted; the stamina are definite, opposite the petals or lobes of the corolla, hypogynous in the synpetalous species, epipetalous in the others. The filaments are straight in æstivation; the anthers 2-celled, with parallel contiguous locules, distinct below, and dehiscent lengthwise by chinks. The pollen is round or oval, and covered with mucilage; the germen is free, sessile, 1-ovuled, the ovule pendulous from a lengthened podosperm arising from the bottom of the ovary; the styles 5 (seldom 4 or 3), distinct, seldom connate; and the stigmata equal to them in number.

The fruit is membranaceous, utricular, irregular, dehiscent, or scarcely opening; the seed solitary and inverted, with a simple covering, not mucilaginous; the albumen farinaceous, the embryo straight and axile, and the radicle superior.

(4677.) Hence, selecting the chief differential characters, the *Armeriaceæ* are syn- or apo-petalous *Plantaginæ*, with regular flowers, the stamens straight in æstivation, the calyx 5-plicate; a utricular, scarcely dehiscent fruit, and solitary seeds, pendulous from a lengthened basal podosperm, and mealy albumen.

(4678.) The diversity found amongst the genera as to the union or discretion of the petals and styles, has caused two subtypes to be instituted, and their difference in properties would appear to sanction the proposed segregation. These, from *Plumbago* and *Statice*, are called the *Plumbaginidæ* and *Staticidæ*.

(4679.) In the *Plumbaginidæ* the corolla is synpetalous, the styles connate, and the fruit subcapsular;

(4680.) While in the *Staticidæ* the corolla is pentapetalous, the styles distinct, and the fruit irregularly dehiscent from its base.

(4681.) *Plumbaginidæ.* The different species of *Plumbago* are remarkable for the acridity of their juices. One was used in ancient times as a stimulating application to remove opacity of the *cornea*, which disease was then called *Plum-*

C

Plumbago cyanea.

c. Cutting, to shew leaves and inflorescence.

(*a*) Æstivation of the corolla.

(*b*) Calyx and pistil, the corolla being removed.

(*c*) Pistil and stamens.

(*d*) Section of an ovary, to shew the ovule pendulous from the elongated podosperm, which arises from the bottom of the ovary.

(*e*) The seed.

(*f*) Transverse section.

(*g*) Longitudinal ditto, to shew the embryo.

bum, and hence the present generic name. *P. Europæa*, like other acrid plants, has been used to relieve toothach; and by the French it is called *dentelaire*, or toothwort. In decoction it has also been recommended as a stimulating wash to old and sluggish ulcers, and as a kind of potential cautery to cancers; but Sauvage de la Croix says, that a young woman, who had it applied, affirmed that the pain it occasioned was intolerable, and that she felt as if being "flayed alive." It is said to be a certain cure for the mange in dogs and horses, and, like the ranunculi, is sometimes used by beggars to ulcerate their skin. *Plumbago rosea*, the blister-root of Rumphius, as well as the bruised bark and root of *P. Zeylanica* and *scandens*, will raise vesications like cantharides; the latter, on account of its acridity, is called the *Devil's wort* in St. Domingo. *P. Europæa*, administered internally in small doses, is said to be as effectual an emetic as ipecacuan.

(4682.) Staticidæ. The thrift (*Armeria*), and sea-lavender (*Statice*), are, like the *Plumbagines*, very ornamental plants; but they differ greatly from them in their properties. They are bitter, tonic, and astringent; and several have been found very serviceable medicines in diarrhœa and dysentery. *Statice Caroliniania* is said to be one of the most powerful astringents known. The root is the part employed, and in America it is much esteemed.

(4683.) Globulariaceæ. The *Globulariæ*, which form this type, are low shrubs, undershrubs, or perennial herbaceous plants, with roundish non-articulated branches, simple, entire, marcescent leaves, alternate or crowded, exstipulate, and nigrescent.

The inflorescence is terminal or axillary, capitulate, the receptacle being convex, pedunculate, paleaceous, and girded by a polyphyllous abbreviated involucrum. The flowers are irregular, seldom regular, and united.

The calyx is free, persistent, herbaceous, synsepalous, and bilabiate, the upper lip being trifid, the lower bifid; seldom regular, with a 5-cleft limb. The corolla is hypogynous, synpetalous, tubulose with an unequal limb, two-lipped, rarely unilabiate, the upper lip the smallest, bipartite or obsolete, the lower trifid and elongated; seldom regular. The torus is obsolete. The stamens 4, exserted from the upper part of the tube of the corolla, and alternate with its lobes, the axial or upper stamen being wanting, and the others somewhat didynamous. The filaments are free, capillary, and incurved in æstivation. The anthers reniform and versatile, 2-celled, the cells confluent into 1, and dehiscent lengthwise by chinks. The germen is free, 1-celled, with a solitary ovule, pendulous from an elongated podosperm. The style 1 and terminal, and the stigma simple or emarginate.

The fruit is utricular, small, and indehiscent; surmounted by the persistent style, and invested by the calyx. The seed solitary and pendulous, the albumen fleshy, the embryo straight and axile, the radicle superior, and about the length of the cotyledons, which are ovate.

(4684.) Hence, differentially considered, the *Globulariaceæ* are capitate *Plantaginæ*, with mostly irregular flowers; the stamens alternating with the lobes of the corolla, and often didynamous; the fruit superior, 1-celled, indehiscent, and monospermous; and the seed pendulous, with fleshy albumen.

(4685.) The *Globulariæ* are reputed to possess bitter and cathartic powers, but are destitute of any especial acridity; although one species, *G. Alypum*, has been supposed to be the *αλυπον* of *Dioscorides*, and hence described in the works of Lobel, Bauhin, and the older botanists, under the formidable title of "*Herba vel Frutex terribilis.*" The *Alypum* of the ancients was probably a species of *Euphorbia*, for it is described as having very caustic juices, and their plant might merit the epithet *terrible*, but the one in question is no more to be dreaded than any other drastic cathartic. *G. nudicaulis* is also purgative; and *G. vulgaris*, which participates in the properties of both the preceding, is said by Lemery to have been employed as a resolvent and vulnerary.

(4686.) The *Globulariæ* differ so little from the *Dipsaceæ* in their general structure, that, were it not for their free superior germen, they might be associated immediately with them; and even as it is, considering that the germen in *Dipsaceæ* is sometimes scarcely inferior, and the peculiar circumstance of the ovarium being occasionally free, although the calyx is superior, it seems to be a debateable point as to whether they might not with propriety be admitted as a subtype. At all events, they shew the close connexion which exists between these types, and become another evident link in that beautiful chain of affinities which pervades the whole vegetable kingdom, associating and assimilating the most distant, and apparently the most discordant parts.

(4687.) The demonstration of the types and sections in which the genera comprehended in the order Syringales have been distributed and arranged being now concluded, it only remains to add the usual tabular conspectus of the whole.

Order.	Suborders.	Sections.	Types.	Sub-types and districts.
SYRINGALES (4107.)	PRIMULOSÆ (4365, 4111.)	PLANTAGINÆ (4672.)	*Globulariaceæ* (4683-4.)	
			Armeriaceæ (4676-7.)	Staticidæ (4680.)
				Plumbaginidæ (4679.)
			Plantaginaceæ (4673-4.)	
		PRIMULINÆ (4637.)	*Primulaceæ* (4660-1.)	Primulidæ (4664.)
				Myrsinidæ (4663.)
			Oleaceæ (4638-9.)	Fraxinidæ (4643.)
				Ligustreæ (4648.)
				Fraxineæ (4647.)
				Syringeæ (4646.)
				Jasminidæ (4642.)
				Columellidæ (4641.)
		GENTIANINÆ (4585.)	*Loganiaceæ* (4631-2.)	Loganidæ (4634.)
				Potalidæ (4633.)
			Strychnaceæ (4596-7.)	Stapelidæ (4601.)
				Apocynidæ (4600.)
			Gentianaceæ (4586-7.)	Spigelidæ (4591.)
				Gentianidæ (4590.)
				Menyanthidæ (4589.)
		SOLANINÆ (4431.)	*Boraginaceæ* (4565-6.)	Boraginidæ (4570.)
				Heliotropidæ (4569.)
				Heliotropieæ (4575.)
				Ehretieæ (4574.)
				Cordieæ (4573.)
				Hydrophyllidæ (4568.)
			Hydroleaceæ (4562-3.)	
			Convolvulaceæ (4545-6.)	Cuscutidæ (4549.)
				Convolvulidæ (4548.)
			Polemoniaceæ (4537-8.)	
			Solanaceæ (4475-6.)	Cestridæ (4481.)
				Solanidæ (4480.)
				Nolanidæ (4479.)
				Verbascidæ (4478.)
		MENTHINÆ (4369.)	*Scrophulariaceæ* (4551-2.)	Scrophularidæ (4454.)
				Rhinanthidæ (4454.)
			Utriculariaceæ (4446-7.)	
			Menthaceæ or *Labiatæ* (4415-6.)	Ocymidæ (4419.)
				Prasidæ (4419.)
				Nepetidæ (4419.)
				Monardidæ (4419.)
				Ajugidæ (4419.)
				Saturidæ (4419.)
				Menthidæ (4419.)
			Verbenaceæ (4400-1.)	Verbenidæ (4405.)
				Myoporidæ (4404.)
				Selaginidæ (4403.)
			Bignoniaceæ (4395-6.)	
			Acanthaceæ (4384-5.)	Sesamidæ (4389.)
				Cyrtandridæ (4388.)
				Acanthidæ (4387.)
			Orobanchaceæ (4378-9.)	
			Gesneriaceæ (4371-2.)	Besleridæ (4374.)
				Gesneridæ (4375.)
	ERICOSÆ (4279, 4110.)	STYRACINÆ (4341.)	*Ebenaceæ* (4359-60.)	
			Sapotaceæ (4354-5.)	
			Belvisiaceæ (4350-1.)	
			Styraceæ (4342-3.)	
		ERICINÆ (4305.)	*Epacridaceæ* (4333-4.)	Epacridæ (4337.)
				Styphelidæ (4336.)
			Ericaceæ (4313-4.)	Ericidæ (4317.)
				Ericeæ (4321.)
				Rhodoreæ (4320.)
				Pyrolidæ (4316.)
			Vacciniaceæ (4307.)	
		CAMPANULINÆ (4283.)	*Campanulaceæ* (4295-6.)	Lobelidæ (4298.)
				Campanulidæ (4299.)
			Stylidiaceæ (4292-3.)	
			Goodeniaceæ (4284-5.)	Goodenovidæ (4289.)
				Scævolidæ (4288.)
				Brunonidæ (4287.)
	ASTEROSÆ (4109.)	ASTERINÆ (4202-3.): ASTERIANÆ (4208.)	*Cichoraceæ* (4221.)	COMPOSITÆ.
			Mutisiaceæ or *Labiatifloræ* (4222-65.)	
			Cynaraceæ or *Cynarocephalæ* (4220.)	
			Asteraceæ or *Corymbiferæ* (4219.)	
		ASTERINÆ (4202-3.): CALYCERIANÆ (4207.)	*Calyceraceæ* (4210-11.)	
		VALERINÆ. (4186.)	*Dipsaceæ* (4191-2.)	Scabiosidæ (4195.)
				Morinidæ (4194.)
			Valerianaceæ (4187-8.)	
		RUBIACINÆ (4114.)	*Rubiaceæ* (4178-9.)	
			Cinchonaceæ (4125-6.)	
			Mono-di-spermæ. (4128.)	Opercularidæ (4175.)
				Anthospermidæ (4173.)
				Spermacocidæ (4169.)
				Coffeidæ (4160.)
				Pæderidæ (4157.)
				Guettardidæ (4154.)
				Cordieridæ (4153.)
			Polyspermæ. (4128.)	Hamelidæ (4151.)
				Isertidæ (4150.)
				Hedyotidæ (4147.)
				Gardenidæ (4143.)
				Cinchonidæ (4130.)
			Caprifoliaceæ (4115-6.)	Sambucidæ (4118.)
				Loniceridæ (4119.)

GEOGRAPHICAL DISTRIBUTION OF THE ROSARES.

(4688.) The *Rosares* form as it were the especial vegetation of the present epoch. Whatever may have been their relative proportions to the other tribes in different and distant eras, they constitute more than two-thirds of the now existing Flora. Their geographical range is therefore, as might have been expected, if not absolutely more extended than that of some of the foregoing classes, more general, and their distribution much more abundant, not only as compared with either of the others singly, but more so than the whole combined. The *Rosares* constitute, in fact, THE *Flora* of our times: other plants, such as the *Ferns* and the *Zamias*, with the southern *Pines*, may have predominated in former ages; and, from the proportion in which their fossil remains are found, it is not improbable that they did so. Others, such as the *Selanthi*, may increase their ratio hereafter; but, however this may be, certain it is, that *these* are the prevailing plants of this our day. For, although some of the preceding groups, as the *Grasses* and the *Fungi*, perhaps may equal them in the number of existing individuals, they are beyond comparison their inferiors in the numerical amount of forms specifically distinct. The *Rosares* quadruple the *Gramina* and *Palmares* combined; they count above fourfold the sum of all the agamic tribes, that is, the *Fungi* and *Algæ*, with the *Lichens*, put together; they are about nineteen times as many as the *Ferns*, in their most comprehensive scope; upwards of twenty times as numerous as the *Mosses*; they are considerably more than 200 times as many as the *Pinares*; and, as to the remaining class, its numbers are so comparatively insignificant, that a proportional estimate would seem almost ridiculous. Such being the case, the local as well as the general distribution of the *Rosares*, that is, their stations and habitations, or topographical range, as well as their regional distribution, or prevalence in certain zones, and absence from certain districts; and furthermore, their statistical distribution, or the abundance in which they can be produced, and the ratio they bear to the other classes of plants in different climates, will comprehend a multitude of particulars, a host of curious facts connected with the soil and climate, and the meteorological condition of the various parts of the globe; facts, not only valuable to science, but subservient to the arts, and hence of importance to all men, whether they chiefly regard the comfort of their bodies or the culture of their minds: for upon such, still too often unobserved foundations, not only the manners and customs, but the habits of idleness or industry, the commercial pursuits, and not unfrequently the political rank of nations, in a great measure depend.

(4689.) The topographical distribution, as affording the elements of the more general views, as yielding the materials of the regional and statistical accounts, must of course be the first described, the special stations and habitations of the types in each order being separately considered; and then an estimate attempted of the general distribution of the whole.

QUERNEALES.

(4690.) QUERCINÆ. The *Casuarinaceæ*, with which this order opens, and by which it is connected with the *Equisetaceæ* of the *Ferns*, as well as to the *Taxaceæ* of the *Pinares* through *Ephedra*, (§ 1450,) are, like the *Ephedræ*, in

general, inhabitants of cold and temperate regions; they are, however, only found in the southern hemisphere, their immediate associates, the *Myricaceæ*, representing them in similar climates of the northern, to which however these latter are not confined, as they occur almost equally in parallel latitudes on both sides of the equator.

(4691.) The *Salicaceæ*, or willows, have the most northern range of any of the arboreous rosares. *Salix livida* occurs in Lapland, *S. herbacea* in Iceland, *S. polaris* in Spitzbergen, and the north of Norway; and specimens of *S. arctica* were brought by Parry and his adventurous companions from the per-arctic regions, as the only representative there existing of the forest monarchs of more temperate climes, but still a tree, although attaining to the height of two or three inches only. The willows and poplars are, however, more prevalent in the temperate zones; and a few extend even towards the tropics, some being found in Greece, Egypt, Barbary, and even in Senegal, as well as in Mexico and Peru.

(4692.) The *Betulaceæ* are also the plants of cold and temperate regions, but less extensive in their range than the *Salicaceæ*, either towards the equator or the poles: three species are found in Nepal, and one, *Betula antarctica*, in the island of Chiloe; but the majority are natives of the colder parts of the temperate zones of America, Europe, and Asia, especially of Lapland and Siberia, where vast forests are found, and where the afflictive birch, cursed by unlettered youth, supplies most of the necessities of man, and, as the beech in the silver age,

> " Sellas, armaria, lectos
> Et mensas dabat et lances et pocula:"

and hence there, like the olive-branch in more temperate climes, a birchen rod might be, not improperly, esteemed a symbol of amity and love.

(4693.) The *Corylaceæ*, including the oak, chesnut, beech, hazle, &c. are inhabitants of the temperate regions, both in the eastern and western hemispheres; less northern in their range, however, than either of the preceding types, and likewise less tolerant of heat; for, although common in the Levant, in the southern parts of Europe, and in the northern ones of Asia, they either desert the plains, and fly for refuge to the more moderate heat of the mountains, or degenerate in size, the oaks often becoming as it were bushes or dwarfish shrubs. These plants, although common in parallel latitudes of the Old and the New Worlds, are denizens chiefly of the northern hemisphere, being very rare in Paraguay and Chili, and unknown at the Cape of Good Hope.

(4694.) The *Juglandaceæ*, which might with some shew of reason be called resiniferous *Corylaceæ*, are, like them, the most prevalent in temperate latitudes. It is in North America that the hickories and walnuts are chiefly found, but some are natives of the more southern states, as Carolina and Georgia; while others are found in Greece, Persia, different parts of Asia Minor, and one in St. Domingo.

(4695.) Hence it would appear that, as a general rule, the *Quercinæ* are most prevalent in the frigid zone, or in the colder parts of the temperate regions; and although they have continual tendencies towards the tropics, those which are natives of warm latitudes are comparatively few in number.

(4696.) Ulminæ. The elms are plants of the north temperate regions, but the genus *Celtis* extends from the northern parts of America to the tropics, being

found, however, most abundantly towards the line, as in New Spain and in Brazil. Their allies, the *Chailletiaceæ* and *Aquilariaceæ*, are also tropical plants; but their number is so small, that their distribution might be expected to be very local.

(4697.) Urticinæ. The *Urticaceæ*, which form the normal type of the present section, have a very wide geographical range, the nettles, or some of their representatives, being met with in almost every country from the tropics to the poles. Their stations are also no less varied than their habitations, for some are found on hills, others in the plains; some retire to the dampest and shadiest coverts of the woods, while others delight in warm and open, yet protected vales; some will flourish only in rich and deep alluvial soil, while others cover rocks and walls, and are only found in such barren and food-denying spots. The *Lacistemæ* inhabit the vast forests of equinoctial America; the *hemp* and the *hop* extend from Bengal to Russia; and the *Urticæ* and *Parietariæ* are found everywhere.

(4698.) The sectional associates of the *Urticaceæ*, if not much more restricted, are more definite in their distribution. The *Stilaginaceæ* are East Indian plants; and of the *Platanaceæ*, the *Antiaridæ* are natives of Java; the *Artocarpidæ*, for the most part of tropical latitudes, particularly of China, Persia, and the peninsula of Hindustan; some extend to Australia on the one side, and to the southern parts of Europe on the other; where the figs and mulberries meet the *Platanidæ*, which abound in the Levant and on the Mediterranean shores. In the western hemisphere a similar distribution of the *Artocarpidæ* and *Platinidæ* occurs, for they are present, by some of their species, from Brazil to Canada.

(4699.) The *Datiscaceæ*, although very few in numbers, are scattered, like the *Urticaceæ*, all over the world. They occur both in India and Siberia, and in parallel latitudes in North America. The *Monimiaceæ*, equally insignificant in number, are confined to the Southern hemisphere, the *Amboridæ* being all natives of South America, and the *Atherospermidæ* of the same continent, and of New Holland.

(4700.) Hence, collectively considered, the *Urticinæ* are wanderers over the face of the earth; evidently receding from the northern tendency of the preceding sections, but not having established an equinoctial bias. They would, in their distribution, appear to be evidently transitional from the sections that precede, in which the amentiform inflorescence and the prefoliate flowering, so well adapted to the colder climates, is found, to some of the types of the succeeding one, which afford those fragrant oils and incomparable spices that require an equatorial sun to bring them to perfection.

(4701.) Laurinæ. The *Lauraceæ* are tropical plants; in very few instances do they extend even into the temperate regions, and there are none that approach the frigid zones. Their principal range is within 20° on either side of the equator; very few, as the bay (*L. nobilis*), being found in the southern parts of Europe, or as the sassafras and benzoin-laurels, in North America. It is worthy of remark, that, although the *Lauridæ* abound in the torrid zone, both in America and Asia, none have hitherto been found within the same parallels, nor indeed in any part of Continental Africa, although they are known to exist in the neighbouring islands of Madagascar, France, and Bourbon, at its south-eastern extremity; and in Madeira, lying in the same latitude as its north-western parts. The curious, leafless, parasitical *Cassythidæ*, are the only representatives of the *Lauraceæ* on the continent of Africa; but they are not confined to it, being also found

in the equatorial regions of Asia and America, as well as in New Holland and Van Dieman's Land. A somewhat analogous circumstance is noticeable with respect to the distribution of the *Zamiales*. [§ 1450.]

(4702.) The *Myristicaceæ*, nearly allied to the *Lauraceæ* in structure, are, like them, tropical plants; but here the tendency towards the equator, evident in the distribution of the foregoing type, has become absolute: for, although occurring in either hemisphere, they are exclusively confined to the torrid zone.

(4703.) The *Hernandiaceæ* are so few in number, that their distribution is rather of a local than a general character. They are natives of the warm latitudes both of the Old and New Worlds, being found in the East and West Indies, in the islands of Cayenne and Mascaren, and in Guiana.

(4704.) Of the *Thymelæaceæ*, the subtype *Thymelidæ*, although affecting a tropical range, evidently shews a tendency towards the poles, being chiefly found in those parts of the torrid zone where the temperature is moderate, and in the warmer ones of the temperate regions, as in Asia Minor, the Cape of Good Hope, New Holland, China, Cochin-china, and Japan. Some are found in Jamaica and in Quito, under the line, where, however, altitude compensates for the lowness of latitude; and a few, but very few, as *D. Laureola* and *Mezereum*, extend northwards into Europe. The *Elæagnidæ* (which form the co-ordinate subtype) are, like the *Thymelidæ*, found both in warm and cold countries, but they have a contrary tendency; for, although extending from Sumatra and Ceylon to Japan and Siberia, in the eastern world, and from Guiana to Canada, in the western, it is chiefly in the cold and temperate regions they predominate; and, what is likewise worthy of remark, although abundant in the northern, they are unknown in the southern hemisphere.

(4705.) The *Proteaceæ* are in one respect exactly the reverse of the *Elæagnidæ* in their distribution; for they are almost exclusively confined to the southern hemisphere, very few being found north of the line, and those few considerably within the tropics. This is the more remarkable, as, like the *Elæagnidæ*, they have a very extensive range, not merely, as Brown observes, in latitude and longitude, but also in altitude, being natives both of the mountains and the plains, and occurring in the western hemisphere from Guiana and Peru to Terra del Fuego, and in the eastern from the Cape of Good Hope to Van Dieman's Land; and likewise as they are met with both inland and on the sea-coast; and several are found in bogs and wet situations, although the majority love dry and stony, or even sandy soils.

(4706.) Of the *Penæaceæ* little need be said. They are allied to the *Proteaceæ* in structure, and, like a part of that family, are natives of the Cape of Good Hope, where indeed they are exclusively found.

(4707.) The *Santalaceæ*, which are closely allied to the *Thymelæaceæ*, combine as it were the geographical range of both its subtypes, being widely diffused through the torrid and temperate zones on both sides of the line, and equally in either world. In the warmer latitudes they occur as noble trees, but in the colder regions are often reduced to the condition of obscure shrubs or herbaceous weeds. The arboreous sandals, the shrubby *Thesia*, and the half-herbaceous *Osyrides*, are examples of this change in port.

(4708.) The *Terminaliaceæ*, which are allied to the arboreous *Santalaceæ*, like them, are the natives of warm countries; they occur in various parts of Ame-

rica, Africa, and Asia, lying within the torrid zone, to which they are confined, not a single extratropical species being known.

(4709.) Hence, collectively considered, the *Laurinæ* are decidedly tropical in their distribution; for, although some of the types are very widely diffused, the tendency is towards the equator; none are wholly confined to the temperate regions, while several are chiefly, and two or three exclusively, equatorial groups.

(4710.) Hippurinæ. Like most of the aquatic series, these types are very widely diffused. Thus, the *Trapaceæ* are the pond and river weeds of the East Indies, China, and the south of Europe; the *Hippuridaceæ* are common in the fresh waters of every latitude, from China and Japan to the northern parts of Europe and America, and the southern ones of Africa, New Holland, and the islands of the great South Sea, the more equable temperature of the water allowing them a wider range than is common to most land plants.

(4711.) Piperinæ. The *Piperaceæ* are exclusively equinoctial plants. They are almost wholly confined to the torrid zone, and chiefly abundant in the hottest parts of the East and West Indies, as in Jamaica, St. Domingo, Brazil, Java, Sumatra, and the coast of the Gulf of Siam. The *Chloranthaceæ* are also natives of the East and West Indies, of the hotter parts of South America, of Java, and of the Society Isles. The other associated type, the *Saururaceæ*, are extratropical, being as it were representatives of the two preceding groups in the temperate parts of China, in the north of India, at the Cape of Good Hope, and as far north as Virginia, in the United States of America.

(4712.) Asarinæ. The *Aristolochidæ* of the *Aristolochiaceæ* are found in abundance in the equinoctial parts of America; Mexico, Jamaica, Hispaniola, and the Caraccas, being their head-quarters. Some few are found on the shores and islands of the Mediterranean; and a solitary species (*A. Clematitis*) occurs in Britain. The *Asaridæ* are the northern representatives of the type, for they are found not only in China and Japan, but also in the northern parts of America and Europe. The *Nepenthes*, which constitute the associated type *Nepenthaceæ*, are natives of the swamps of Ceylon, the East Indies, and China.

(4713.) Rumicinæ. Of the *Petiveriaceæ*, the *Petiveridæ* are natives of the West Indies, and the tropical parts of continental America; while the *Phytolaccidæ* are found in either hemisphere, and both within and without the tropics, but principally in the warmer parts of the north temperate zone, none being indigenous in Europe, although an American species (*Phytolacca decandra*) has been naturalized in its more southern parts, as in Spain and Portugal, and the Mediterranean provinces of France.

(4714.) The *Betaceæ* are scattered all over the world; they are useful dietetic vegetables, and hence much benefit is derived from their wide diffusion. The *Amarantidæ*, however, are chiefly prevalent in the warmer regions, and none are known in very cold climates; while, on the contrary, the *Chenopodidæ* prevail in the temperate and cold latitudes, and are the least abundant within the tropics. And the same holds good with respect to the *Scleranthaceæ*, very few of which occur within the torrid zone. One only is found in Peru, a very small number in Mexico, and the others are scattered over the more barren parts of Europe, Asia, and North America.

(4715.) The *Nyctaginaceæ*, on the contrary, are chiefly distributed throughout

the warmer parts of the world, as in the East and West Indies, Mexico and Peru, Guinea and Madagascar; and as few of them are found without the tropics as of the *Scleranthaceæ* within. Some of the species of *Oxybaphus* are however met with in Louisiana, several *Abroniæ* in California, and one, *Pisonia*, in New Holland.

(4716.) The *Polygonaceæ*, which conclude this section, confirm the character for wide distribution for which the other types contend. These are perfect cosmopolites, being present in one form or other from the equator to the pole. The *Coccolobæ*, or sea-side grapes, are examples of their tropical representatives. As rhubarb and buck-wheat, they abound in the south temperate regions, and as docks and sorrels in the northern ones; while the *Oxyria*, or mountain-sorrel of our latitudes, is found upon the plains within the arctic circle.

(4717.) Euphorbinæ. The *Begoniaceæ*, which are the transitional series from the *Rumicinæ* to the present section, have a distribution analogous to the more tropical genera of the *Polygonaceæ*. The *Begoniæ* are altogether tropical, or scarcely extratropical plants; they are common both in the East and West Indies, and on the American and Asiatic continents; but, with respect to Africa, there is here another exception like that mentioned with regard to the *Lauridæ* (§ 4654), that none are found on the continental parts, although they occur on the neighbouring islands of Madagascar, Bourbon, France, and Johanna.

(4718.) The *Euphorbiaceæ*, although a very extensive type, have not a very extended distribution. They are decidedly the plants of the torrid zone, abounding within the tropics as noble trees and succulent shrubs, of strange and uncouth aspect, being less numerous even in the warmer parts of the temperate zones, and diminishing rapidly in number and degrading in bulk in the colder temperate regions; in the northern parts of Europe and America being principally herbs; and, when the latitudes are high, they become very rare: 16 species only are indigenous to Britain, 9 to Sweden, and in Canada they are scarcely known. A greater number of the described species belong to the New than to the Old World; this is probably owing rather to the tropical parts of America being more accessible than similar latitudes in Africa and Asia, than to any great disparity actually existing.

(4719.) The *Empetraceæ*, though forming a very small group, are very widely scattered. It would seem as if they were to represent this section in higher latitudes than either of the preceding types can bear; for, as the *Begoniaceæ* and the *Euphorbiaceæ* are plants of the torrid zone, and of the warmer parts of the temperate regions, so these occur in the colder countries both of the northern and southern hemispheres, being found in the Highlands of Scotland, in Siberia, and in North America, and at the most southern extremity of that vast continent, viz. in Falkland Island, and on the shores of the Straits of Magellan.

(4720.) Hence, collectively viewed, the *Euphorbinæ* are decidedly tropical plants, the most so of any of the *Querneales*; for the *Empetraceæ* are so few in number, that even were they not native in Portugal, as well as near both the arctic and antarctic circles, they would scarcely be admitted as exceptions to the general rule.

(4721.) The order *Querneales* is therefore found to comprehend plants belonging to every latitude; vegetables proper to every climate, from the equator to either pole. On the whole, they seem to predominate in the temperate and frigid rather than in the equatorial regions. This statement, however, refers to their

average predominance alone; yet these averages are sometimes drawn from data which cannot but be regarded as wholly satisfactory, and therefore it is right that they should be doubtingly offered and conditionally received; *i. e.* offered and received as attempts to approach rather than as absolute approximations to the truth. Many more facts must be collected, and much more laborious research be carried on, before science will be put in possession of the materials upon which to found really just and conclusive calculations.

ROSALES.

(4722.) ILICINÆ. The *Aquifoliaceæ* include two small subtypes, the first of which, the *Stackhousidæ*, is transitional from the *Euphorbiaceæ* of the preceding order to the *Celastraceæ* of the present. It contains but very few known plants, and all that have been hitherto discovered are natives of New Holland. The associated *Aquifolidæ* are, on the contrary, scattered over most parts of the world, being, however, chiefly found in the warmer regions, such as in Jamaica, Trinidad, and the other West Indian Islands, in Brazil, Florida, and Georgia, stretching, however, into other parts of South and North America. In the Old World they principally occur at the Cape of Good Hope, some few in Nepal, Japan, and China, in Madeira, the Canaries, and the islands of the Mediterranean; and one, the common holly, extends as far north as Britain.

(4723.) The *Celastraceæ* are likewise widely dispersed; they are natives of the warmer parts of both hemispheres; but, although some are found in Madagascar, Mexico, and Peru, they are more common in the warmer extratropical regions than within the torrid zone. One species of *Staphylea* and one of *Euonymus* are indigenous in Britain, and about five are found in North America. The *Bruniaceæ* are all natives of the Cape of Good Hope, with the exception of a single species that is found in Madagascar. The *Rhamnaceæ* are extended in their general, but confined in their special distribution, for some representatives of the type are found in almost every part of the torrid and temperate zones, being only absent from the polar circles, and yet several of the genera are met with in particular countries only. Thus, *Cryptandra* and *Pomaderris* are confined to Australia; *Phyllica* and *Soulangia* to the Cape of Good Hope; and *Ceanothus* to North America; while the *Zizyphi* and *Rhamni* are met with everywhere. Hence the *Ilicinæ* are predominant in the warmest part of the temperate regions, not absent from the equinoctial zone, but unknown in the polar regions.

(4724.) TEREBINTHINÆ. The *Cassuviaceæ* are chiefly tropical plants, some few extending into the temperate zones both of the northern and southern hemispheres. The *Spondiaceæ* are confined within the tropics, but occurring, like the *Cassuviaceæ*, both in the eastern and the western worlds. And the *Burseraceæ* are also natives of the torrid zone. The types contained in this section have therefore a decidedly equatorial range.

(4725.) CICERINÆ. The *Connaraceæ* are very few in number, but all that are known are tropical plants. Of the two subsections, *Lotianæ* and *Mimosianæ*, including the *Papilionaceæ* and *Lomentaceæ*, it is found that, although, like most extensive groups, they have a very extended range, yet that the latter, including the *Cassuviaceæ*, *Mimosaceæ*, and *Detariaceæ*, are more tropical in their tendency than the former, the *Lotaceæ* and *Lathyraceæ* certainly predominating in the temperate zones. Taken collectively, their maximum is in the torrid zone, but

separately, that of the *Lotianæ* in the northern, that of the *Mimosianæ* in the southern temperate regions; the numbers, as calculated by De Candolle, being for the equinoctial zone 1602, for the north temperate 1312, for the south temperate 524; the *Lotianæ* being to the *Mimosianæ* in the torrid zone as 910 to 692, in the north temperate as 1277 to 35, and in the south temperate as 417 to 107. The distribution is so general all over the world, excluding the polar circles, that it would be a vain task to specify particular countries; those only need be mentioned in which they do not occur, viz. the islands of St. Helena and of Tristan d'Acunha. But, although thus general in their distribution, certain genera are peculiar to certain situations. Thus the Australian genera are for the most part peculiar to that strange land, which would seem to have a flora as well as a fauna of its own. Several genera are in like manner confined to certain districts in America and Africa, as the Cape of Good Hope; and, even of the European genera there are 14 or 15 unknown in other parts of the world, excepting just on its Mediterranean confines.

(4726.) Rosinæ. Of the *Prunaceæ*, the *Chrysobalanidæ* have a tropical distribution, being chiefly found in the West Indies, Guiana, and Brazil, Sierra Leone and the Isle of Bourbon, and other parts of tropical America and Africa, none having as yet been discovered in Asia. One species, *Chrysobalanus oblongifolius*, is found as far north as Georgia, where it meets with the *Amygdalidæ*, which are as decidedly plants of the cold and temperate regions as the *Chrysobalanidæ* are of the tropics, not above four or five species being known to approach the equator; one of them is the West Indian cherry (*Cerasus occidentalis*), and the others almonds, as *Amygdalus salacina* and *serratula*, and *pseudo-cerasus*, which occur in China, *A. Cochinchinensis* in Cochin-china, and *A. microphylla* in Mexico. It is further remarkable that the *Amygdalidæ* are exclusively found in the northern hemisphere; none have been discovered in South America, in Australasia, nor in any country south of the line.

(4727.) The *Pyraceæ* are also the denizens of the temperate zone, and found exclusively in the northern hemisphere. In Africa likewise they are unknown; in the lower latitudes of Asia they are chiefly to be found in the mountainous districts. In tropical America, and even in the northern parts of Mexico, they are very rare; but in North America, Europe, and in the northern parts of Asia, they are met with in profusion. A solitary representative of the order is said to be found in the Sandwich Islands.

(4728.) The *Rosaceæ*, *Spirææceæ*, and *Sanguisorbaceæ*, are not only associated with the *Prunaceæ* and *Pyraceæ* in structure, but are also very similar to them in their geographical distribution. They are the plants especially of cold and temperate regions, and, although not exclusively found in the northern hemisphere, yet that is their favorite half of the world, very few indeed being met with south of the line. Of the *Rosaceæ*, the true roses (*Rosidæ*) are wholly belonging to the northern hemisphere, none having been found native south of the equator; and this is the more remarkable as they occur on the high lands both in India, Persia, and China. In Australia therefore they are unknown. From Africa also they might almost be said to be absent, for the *Rosa Abyssinica* and *R. moschata*, the former from Abyssinia, and the latter from the northern parts of the Continent and Madeira, are the only native species that have been dis-

covered. In Asia Minor, throughout Europe, and in North America, they are common, even stretching as far north as Kamtschatka and Newfoundland.

(4729.) The *Fragaridæ* represent this type in the tropical regions of America and in the southern hemisphere, although even of these the relative proportion is small. One only (*Rubus Jamaicensis*) is found in the West Indies; a very few insignificant Rubi are all that occur in South America; twelve species of the same genus, and one of Potentilla, are natives of the high lands of tropical Asia; two Rubi (*R. eglanterius* and *macropodus*) have been noticed in New Holland; but at the Cape of Good Hope the type is utterly unknown.

(4730.) The *Spiræaceæ* are also exclusively found in the northern hemisphere, ranging from Columbia to Canada, and from Nipal, China, and Japan, to Britain, Siberia, and Kamtschatka.

(4731.) The *Sanguisorbaceæ* are mostly extratropical plants, but they occur in either hemisphere and in either world, from Mexico to Canada on the one hand, and the Straits of Magellan on the other: but the most remarkable feature in their distribution is, that one large genus (*Cliffortia*) is found exclusively at the Cape of Good Hope, a part of Africa from which all the rest of the *Rosianæ* are absent.

(4732.) Hence it is evident that, as a general rule, the *Rosinæ* are the plants of cold or temperate regions, for, when they are found in tropical countries, they chiefly inhabit the mountainous districts, thus compensating by altitude for the lowness of the latitude. It is also manifest that they are the plants peculiarly of the northern hemisphere; the southern half of the world being often in vast regions wholly without them, and in none are they predominant.

(4733.) MYRTINÆ. Of the *Punicaceæ*, the *Calycanthidæ* are natives of the warmer regions of the north temperate zone, being found native in the southern parts of the United States of America (Carolina), and in Japan. The *Granatidæ* occur in similar parallels, being indigenous to the southern parts of Europe and the northern ones of Africa. They are likewise found in South America and China.

(4734.) Of the *Myrtaceæ*, the *Chamælaucidæ* are exclusively, and the *Leptospermidæ*, with hardly an exception, Australian plants, being natives of New Holland, Van Diemen's Land, and the neighbouring countries. Two species of *Melaleuca* (*Leucadendron* and *minor*), one of *Metrosideros* (*M. vera*), met with in the East Indies, and a species of *Bæckia*, indigenous to China, are the exceptions alluded to. They are likewise found only in the eastern world; in the western continents none have been hitherto discovered. The *Myrtidæ*, on the contrary, instead of affecting the southern hemisphere, are very scarce in Australia; their favorite habitats are within the tropics, and, when they do become extratropical, their tendency is rather to the northern than to the southern zone, extending to the Levant, and to the south of Europe. They are furthermore nearly equal in their distribution in the New and Old Worlds, being found both in the East and West Indies, China and Brazil, the Isles of Bourbon, Trinidad and the Mauritius, the Moluccas and Surinam, Sumatra and Santa Cruz.

(4735.) The *Gustaviaceæ* are all intertropical plants, and, few as they are in number, they occur in either hemisphere, some of the *Barringtonidæ* being natives both of the peninsula of Hindustan and of Guiana; but all the *Lecythidæ* are found beneath the western arc of the torrid zone.

(4736.) The *Memecylaceæ* are also confined to tropical latitudes; but they are met with in both hemispheres, some being natives of Ceylon and the East Indies, and others of Brazil, Guiana, and the West Indian Isles.

(4737.) The *Melastomaceæ* are peculiarly the plants of the torrid zone, very frequently not even approaching the tropics. In America, where about six-sevenths are found, they scarcely extend farther south than Brazil, although in the northern hemisphere eight are indigenous to the United States. In Africa their southern range is limited by the tropic of Capricorn, and to the north by that of Cancer, excepting where the heat and aridity of the great Zahara carries a tropical climate beyond a tropical latitude; but in Asia a few exceed these limits; for, although a vast majority, *i.e.* more than eleven-twelfths of those which are natives of the western world, are found in India and the islands of the East Indian Archipelago, yet three have been discovered in China, and as many in New Holland.

(4738.) Hence it appears that, collectively considered, the *Myrtinæ* are tropical plants, and that they are not only predominant in the torrid zone, but that their tendency is decidedly towards the equinoctial line; none being native in the colder parts of the temperate zones, and as to the frigid zones they are never even approached.

(4739.) Onagrinæ. Of the *Combretaceæ*, the *Alangidæ* are natives of the East Indies; and the *Combretidæ*, of the East and West Indies, and Continental America and Africa, within the tropics, none of either of the subtypes being found without the torrid zone.

(4740.) The *Vochyaceæ* are also found only within the tropics; but these, which are very few in number, are wholly confined to equinoctial America.

(4741.) The *Rhizophoraceæ* are likewise exclusively tropical plants; the *Rhizophoridæ* being, however, peculiar to the eastern, and the *Olisbidæ* and *Cassipouridæ* to the western hemisphere.

(4742.) The *Lythraceæ* are found both within and without the tropics, in both hemispheres, and in both worlds. The *Lagerstræmidæ*, however, are all Chinese, East Indian, or South American plants; while the *Lythridæ* are more common in the northern than in the southern hemisphere, but still more frequent within than without the tropics; yet some are found both in North America and in the north temperate parts of Europe; and it is a curious fact, that our British *Lythrum Salicaria* should also be a native of New Holland, and be the only representative of this order in Australia.

(4743.) Onagraceæ. The succeeding type contains genera that rather affect the temperate than the torrid zone; some of them, however, as the *Jussieuidæ* and *Fuschidæ*, are found in the West Indies, Guiana, Brazil, the Mauritius, and Madagascar, but they in general prefer the coolest parts of the equatorial regions and the temperate zone. In North America they are abundant; some occur at the Cape of Good Hope, some in New Zealand; and they are found almost throughout the whole of Europe, even as far north as Finland.

(4744.) The *Circæaceæ*, formerly a section of the *Onagraceæ*, have, like some of them, a northern distribution. They are natives of Great Britain and Canada.

(4745.) From the foregoing details, it would appear that, although widely diffused throughout the torrid and the temperate zones, the *Onagrinæ*, collectively considered, predominate in the warmer regions; and that, although not decidedly a tropical section, they have a tropical tendency.

(4746.) Crassulinæ. The *Hydrangeaceæ* are the plants of temperate latitudes, few of them extending within the tropics, and very few being found towards the frigid zones. The *Hydrangidæ* are natives of the northern parts of India and China, in the eastern, and of Virginia and Florida, in the western world. The *Philadelphidæ* are indigenous to the south of Europe, Carolina, and the neighbouring states of North America.

(4747.) The *Hamameliaceæ*, although a very limited group, are not equally limited in their distribution; for they are found both in the north of China or Japan, as well as in North America.

(4748.) The *Saxifragaceæ* are natives chiefly of rocky alpine districts, in various parts of the temperate and frigid zones, and, when found within the tropics, enjoying in general a temperate climate, by their hilly stations. The *Cunonidæ* are natives of the East Indies, the Cape of Good Hope, Peru, Chili, and other parts of South America. The *Escallonidæ* are also South American plants, and especially occur in Chili. The *Baueræ*, which alone constitute the *Baueridæ*, are found in New South Wales; *Heuchera*, of the *Heucheridæ*, in North America; and the *Saxifragidæ* chiefly in the northern or mountainous parts of Europe, although some are found in Nepal and China, and others as far north as Siberia and Baffin's Bay. On the average, the *Saxifragaceæ* are plants of the north temperate and frigid zones, and rather of the northern than of the southern hemisphere.

(4749.) The *Crassulaceæ*, it is remarkable, although natives of the driest and most barren soils, are not so much tropical as extratropical plants: for, putting out of the question *Cephalolotus*, a native of the sandy swamps of New Holland, and *Francoa* and *Galax*, indigenous to the temperate parts of North and South America, and which form the two very small subtypes *Cephalotidæ* and *Galacidæ*, hardly belonging to the group, the extensive subtype *Crassulidæ* will more than substantiate the statement. Of these plants, it appears, on the authority of De Candolle, that of the 272 known species 133 are found at the Cape of Good Hope, 1 in Southern Africa, beyond the limits of the Cape, none are known to exist in tropical Africa, but 27 are indigenous to its northern parts, viz. 9 to Barbary, and 18 to the Canaries. There have been discovered only 2 in Australia, 3 in the East Indies, and 4 in China and Japan. Thus in the Asiatic tropics few or none are known to exist; but 18 are found in the Levant, and 12 in Siberia. In the western hemisphere the distribution is nearly analogous, for in the West Indies there are none, and in Continental America, within the torrid zone, 2 species only have been discovered; while there are 8 in Mexico, 1 in the United States, and 2 in South America beyond the tropic. Hence they are the inhabitants of most of the sandy deserts of the temperate zones.

(4750.) The *Mesembraceæ*, on the contrary, although in part very similar to the *Crassulaceæ*, and, like them, esteeming soil of secondary import, have often a very diverse distribution, for they form as exclusively the vegetation of the hot sandy plains and barren deserts within the tropics. They abound in the hottest and most arid districts of Africa, receding from the Cape towards the equator. Some few are found in the Zaharran parts of the north of Africa, a very few in the south of Europe, and one or two in China. In the western hemisphere they are much less common than in the eastern, but there they maintain a similar character in their distribution, being found in Peru, the islands of the Pacific Ocean, and a few in Chili; such is the distribution of the chief subtype, the

Mesembryanthidæ. The *Nitraridæ* are natives of the sandy plains in the north of Africa, and the western parts of Asia; one species only has been found in New Holland; while the *Reaumuridæ*, which meet them in the northern parts of Africa, occur also in Syria, and extend the limits of the type to Persia, the shores of the Caspian Sea, and the sandy deserts of Siberia.

(4751.) The *Portulaceæ*, like both the preceding types, are mostly confined to parched and arid sites; they are, however, less definite in their distribution. The *Telephidæ* are chiefly met with in the south and temperate parts of Europe, and the *Portulidæ* occur sparingly in very distant stations; two species are European, viz. *Montia fontana* and *Portulaca oleracea;* the majority, however, are South American or African, more than a fourth of the whole being found at the Cape of Good Hope; and one is a native of Guinea, and another of Arabia; two only have been discovered in New Holland; and the remainder are scattered through the West Indies, Mexico, Peru, and Chili. Some are found in the East Indies, and in other parts of Asia, as far north as Siberia, and they are not wholly absent from North America.

(4752.) The *Fouquieriaceæ*, which are close allies of the *Portulaceæ*, belong exclusively to Mexico.

(4753.) It is not easy to draw a satisfactory sectional average of the geographical distribution of the foregoing associated types, if reference be had to latitude alone; for some, as the *Mesembraceæ* and *Fouquieriaceæ*, have a decidedly tropical range, while others, as the *Saxifragaceæ*, have as decidedly an extratropical diffusion. But the generalization of the most importance regards their station, and they are almost without exception the denizens of sandy plains or alpine rocks, *i. e.* they form the peculiar vegetation of the most sterile places.

(4754.) Grossulinæ. The *Nopalaceæ* or *Cacteæ* are as it were the surrogates of the *Membraceæ* in the western world. They are exclusively American plants, for the few now found in the southern parts of Europe and in Arabia are said to have been unknown before the discoveries of Columbus, and there is every reason to believe that, although now naturalized, they are not native, at least not more than one species, the *Cactus Opuntia.* Their range is likewise tropical, and they are only found in abundance within the torrid zone, or in the hottest parts of the temperate ones immediately contingent. De Candolle gives 32° or 33° as their extreme northern limit, but Lindley quotes an instance of a species native or naturalized in Long Island, 42° north, and of another growing wild in the rocky mountains, in latitude about 49° north; and it is well known that those which have become denizens of Europe grow wild in Italy, about Naples, in north latitude 40° 50″, or even stretch to the 44th degree. Like the *Crassulaceæ* and *Mesembraceæ*, rocks and other arid places are the favorite stations of these plants.

(4755.) The *Grossulaceæ*, although very different in appearance, are intimately allied, and were at one time blended with the *Nopalaceæ;* and in their distribution they seem to supply the place of their former associates in the temperate zones, but are unknown within the tropics, where the others abound. As the *Nopalaceæ* were wholly absent from three quarters of the world, and exclusively confined to America, so the *Grossulaceæ*, although present in three continents, are absent and unknown in the fourth. In the temperate zones of Europe, Asia, and America, they are common; but in Africa, even in the extratropical parts, and in parallels similar to those in which they are found in the other con-

tinents, they are unknown. Their range seems also to be decidedly in the northern hemisphere, for very few have been discovered in Chili, or in any part of South America, although in the northern half of the continent they are most abundant; and in the same way, no notice is taken by travellers of their presence in New Holland, nor in any part of Australia, although it is well known that they are so common in the mountainous regions of northern India, as to give to the vegetation of those parts an European character; and from Hindustan they extend even to Siberia.

(4756.) The *Samydaceæ* and *Homaliaceæ* are both tropical types, differing more in their longitudes than latitudes. The former are natives chiefly of Brazil, Guiana, Mexico, and the West Indies, a few only, as two species of *Casearia*, being indigenous to Eastern India; while the latter are chiefly African or Asiatic, being indigenous to China, Nepal, Madagascar, and the Isle of Bourbon, a few only, as *Aristotelia Maqui* and *Homalium racemosum*, being found in the western hemisphere, this in the West Indies, and that in Chili.

(4757.) The *Passifloraceæ* are natives of the West Indies and of the warmer parts of the American continent. In Brazil, Mexico, and Guiana, in Jamaica, St. Domingo, the Caraccas, and the Bahama Isles, they are most abundant. A few, however, occur in the eastern hemisphere: thus *Smeathmannia*, of the *Paropsidæ*, is a native of Sierra Leone, and so is *Modecca lobata* of the *Passifloridæ;* while the other *Modeccæ* belong to the East Indies. *Disemma Herbertiana* also is a native of New Holland, and *D. adianthifolia* of Norfolk Island. The *Malesherbidæ* are peculiar to Chili.

(4758.) The *Loasaceæ* are exclusively American plants, and chiefly prevailing in the south temperate regions, or in those of the tropics bordering on the temperate zones, as in Mexico, Louisiana, and Chili. The *Turneraceæ* are also believed to belong exclusively to South America and the West Indies, being found in Brazil, Guiana, Trinidad, Jamaica, and St. Domingo. Some doubt, however, exists as to whether *Turnera trioniflora* (the *T. cuneiformis* of South America) may not be a native of Japan.

(4759.) The *Grossulinæ*, collectively considered, are intertropical plants, a large majority being natives of the torrid zone, or of the hotter parts of the temperate regions, while the minority is very small that prevails in the north temperate and frigid circles. Six of the types have decidedly an equatorial tendency; and one only, the *Grossulaceæ*, a decided preference to higher latitudes, or to elevated spots in the tropics.

(4760.) CUCURBITINÆ. The two types, *Cucurbitaceæ* and *Papayaceæ*, included in this section, are tropical in their habitats, or, when extratropical, most common in the hottest parts of the temperate zones. Thus the *Cucurbitaceæ* are most abundant in the East and West Indies; in Nepal, Ceylon, China, and Japan, they are common; several are natives of the Cape of Good Hope, Zanzebar, Guinea, and the Canaries; others of Egypt, Tartary, and Asiatic Russia, but very few are European; the *Elaterium*, and two or three species of *Bryony*, one of which is British, being the only examples; and none are found in parallel latitudes of the southern hemisphere. In the New World they are less prevalent than in the Old; but there they occur chiefly in the warmer parts, as in Jamaica, Trinidad, Mexico, the Caraccas, and Peru; some, but fewer, are found in Buenos Ayres and Chili; and in North America they are as scantily present as in Europe.

(4761.) The *Papayaceæ* are also natives of the tropical parts of America, being found in the Caraccas, Guiana, and Peru. Two species of *Carica* or *Papaya* are said to be African, *P. citriformis* being found in Guinea; and *C. Papaya*, a native of Brazil, is mentioned as having been also found in the interior of Africa by the expedition conducted by Tuckey up the Congo.

(4762.) LORANTHINÆ. The *Loranthaceæ* are chiefly tropical parasites, the equinoctial regions of America and Asia being their principal localities. In Africa within the tropics they are rare, and a few only are natives of the Cape of Good Hope and Madagascar; further towards the poles, in either hemisphere, their number decreases; two only have been noticed in the islands of the Pacific Ocean, and one alone in New Holland. In Europe, in like manner, two or three only are European, and one of these, the mistletoe (*Viscum album*), alone extends as far north as Britain. They are equally rare in the European latitudes of North America; and in New Zealand, 10 degrees nearer the equator than England, there is but one native species known.

(4763.) ANGELICINÆ or *Umbelliferæ*. The three types included in this section are very widely diffused; but the *Angelicaceæ*, which is very much the most extensive, has also the widest range. Many of the *Angelicaceæ* are tropical plants, but the majority are found in the colder parts of the temperate zones, and especially in that of the northern hemisphere; and this tendency is still more obvious in the smaller types; for of the *Smyrniaceæ* scarcely more than half a dozen species, which are natives of the Cape of Good Hope, are found south of the line in the Old World, and less in the New; the *Arracacha* of Columbia, and other parts of South America, being however a memorable exception: and of the *Coriandraceæ*, the whole are North American or European. The following are the results of De Candolle's laborious researches into the geographical range of these important plants:

In the eastern hemisphere	Old World	663	717	890
	Australia	54		
In the western, that is, in America		-	159	
In various scattered islands	-	-	14	

or	In the northern hemisphere	- 679
	—— southern ditto	- 205

(4764.) ARALINÆ. The *Araliaceæ*, which are as it were shrubby or arborescent *Umbelliferæ*, are chiefly found within the tropics: the East and West Indies, China, Tartary, Nepal, Guiana, Peru, and Mexico, are their favorite habitats. Some are found at the Cape of Good Hope, and they even extend southward to New Zealand, and northwards into Virginia, and other parts of North America. *Aralia* and *Hedera*, which are doubtful associates, the latter appearing to belong as much to the *Corneaceæ* as the *Araliaceæ*, are found to have some species natives of the East and West Indies, and others indigenous to Britain.

(4765.) The *Corneaceæ* are met with chiefly in cold and temperate climates; some one or two species have been found native in Nepal and Japan, but the majority belong to the north temperate and frigid zones, and are equally diffused through the eastern and western hemispheres, but none are mentioned as being met with in the southern half of the world.

(4766.) VITINÆ. The *Leeaceæ* are natives of the East Indies, China, the Moluccas, and the Cape of Good Hope, none being found in the western world.

The *Viteaceæ* or *Viniferæ*, which likewise affect the tropics, or are most prevalent in the warmer parts of the temperate zones, are met with in both hemispheres; some being indigenous to Brazil, Mexico, Cayenne, Jamaica, and the other West Indian islands, and several parts of North and South America; as well as to Java and Sumatra, the East Indies, Japan, the Cape of Good Hope, Arabia, and the Levantine countries in general, extending northwards into central Europe, and southwards into Australia; the *Cissus antarctica*, or *Kangaru vine*, being a native of New South Wales. The *Meliaceæ* likewise are chiefly found in the East and West Indies, in the Moluccas, at the Cape of Good Hope, Sierra Leone, Porto Rico, and in Guiana; but they are more decidedly equatorial in their range than the *Viteaceæ*, for but two stretch southwards to Australia, and one only is found as far north as Syria. Hence, as none are met with in very cold latitudes, and the majority within the tropics, the *Vitinæ* must, on the whole, notwithstanding the exceptions, which are several, be regarded as the plants of equatorial regions, and of the warmer parts of the temperate zones.

(4767.) Cistinæ. Of the subsection *Hypericianæ* the *Garciniaceæ* are exclusively tropical in their distribution. They chiefly occur in the equatorial regions of South America and Brazil, Guiana, and the West Indies. They are also found in the East Indies and Java, but less frequently. In continental Africa, south of the line, they are unknown, although they are found in the neighbouring islands of Bourbon and Madagascar, as well as at Sierra Leone, in the north African torrid zone. In Europe, the central and northern parts of Asia, and in Australia, they are unknown.

(4768.) The *Hypericaceæ* are the substitutes for the *Garciniaceæ* in the temperate zones; very few, besides the *Vismidæ*, being found within the tropics, and the majority being natives of the north temperate zone in either hemisphere. *Carpodontos*, of the *Eucryphidæ*, is a native of Van Dieman's Land.

(4769.) The *Frankeniaceæ* are widely scattered: several of the *Frankenidæ* have been found in Australia, at the Cape of Good Hope, and one in South America, but the majority are natives of the countries bounding the Mediterranean sea, whether its African, Asiatic, or European shores. They are wholly absent from North America, and none have been found in tropical Africa or Asia, notwithstanding the *Sauvagesidæ* are natives of Madagascar, indeed, are exclusively confined to Africa and South America.

(4770.) Of the *Cistianæ*, the *Alsodidæ*, which are transitional from the *Sauvagesidæ* to the *Violaceæ*, are, like the former, South American and African plants; one exception only (*Pentaloba*) being known. But the *Violidæ* are rare within the tropics, and common in the more temperate regions of both hemispheres, and of either world. They are, however, more frequent north of the line in the eastern, and south of it in the western world; and it is remarkable, that while the South American *Violidæ* have for the most part a shrubby port, those of the northern hemisphere are as constantly herbaceous plants.

(4771.) The *Droseraceæ* are scattered all over the world. They are marshy plants, and, like other aquatic tribes, have a most extensive distribution. Thus they are found in North and South America, in Madagascar, and at the Cape, in the East Indies and in China, as well as in New Holland and in Britain.

(4772.) The *Cistaceæ* are much more restricted in their range. In the western world they are very rare, the North American species scarcely exceeding 6 or 8;

in South America they are hardly known; in Asia and the south of Africa they are as seldom met with as in America; but in the north of Africa, the Levant, and the southern parts of Europe, they are common.

(4773.) The *Bixaceæ* are natives both of the eastern and western hemispheres, but they are chiefly found in America, and exclusively confined to the tropics.

(4774.) The *Flacourtiaceæ* are likewise almost entirely tropical plants, but they are found to be more prevalent in the Old than in the New World; and, although none extend northwards into the temperate zone, *Melicytus ramiflorus* has been found in New Zealand.

(4775.) The *Marcgraviaceæ* belong exclusively to the torrid zone, and are peculiar to the western hemisphere; indeed, with the exception of *Antholoma montana*, which is a native of New Caledonia, they are altogether confined to the West Indies and Continental America, within the tropics.

(4776.) The *Tamaricaceæ* contrast well in their distribution with the preceding type, for these plants are confined to the eastern hemisphere; and even to its northern half. The shores of the Mediterranean are the head-quarters of the type, but it stretches southwards to the Cape de Verde Islands and the East Indies, and northwards to Britain and Germany, and even to Siberia, in lat. 55° N. Collectively considered, the *Cistinæ*, although occurring both in the torrid and temperate zones, have rather an equatorial tendency. Four types have a decidedly equinoctial range, while but two or three affect the temperate regions.

(4777.) Dianthinæ. The *Elatinaceæ* are marshy plants, and found to be present, by some of their genera, in both worlds, and in either hemisphere. *Elatine* is a European genus, *Merimea* a native of South America, and the *Bergiæ* are indigenous to Africa, both at the Cape, and in Egypt, as well as being found in the East Indies; and *Crypta minima* is one of the marshy plants of Pennsylvania.

(4778.) The *Dianthaceæ* are natives of the north frigid zone, and of the colder parts of the temperate regions; affecting peculiarly a polar climate, either by latitude or altitude. Some few, however, are found in the southern parts of Europe, the north of Africa, and even in southern Africa and Asia, as at the Cape of Good Hope, Nepal, and China. Very few are met with either in North or South America; and hence, notwithstanding the wandering habitats of the *Elatinaceæ*, the *Dianthinæ* may with justice be considered one of the extratropical groups, almost peculiar to the Old World, and more particularly to its northern half.

(4779.) Geraninæ. The *Linaceæ* are chiefly spread over the temperate and southern parts of Europe, and the northern ones of Africa; they are found in Siberia, but are rare in the southern parts of Asia, only two being known to be natives of India; and probably there are none indigenous to New Holland, for *Linum angustifolium*, the only species specimens of which have been sent from Australia, is believed to have been introduced by Europeans. In southern Africa very few have been discovered, and both in North and South America they are comparatively scarce.

(4780.) The Cape of Good Hope is the chief resort of the *Oxalidaceæ*; in Africa within the tropics, and in equatorial Asia, they are rare. In equinoctial America, however, they are abundant, as in Mexico and Brazil, yet not so common immediately under the line as in the hotter parts of the temperate zones, extending into Chili on the south, and the United States on the north, thus bearing

a similitude to their distribution in the eastern hemisphere; as they are found both in New Holland and in Britain.

(4781.) The *Balsaminaceæ* seem chiefly to prevail in the East Indies, China, and at the Cape of Good Hope; but their number, even there, is insignificant. They also extend northwards into Asiatic Russia and Europe, but one species however being found native in each of those vast tracts, and in North America two only are indigenous. The *Cape Balsams,* and one species found in Madagascar, are all that occur in the southern hemisphere, none having been found in New Holland.

(4782.) *Hydrocera,* perhaps scarcely separable from the *Balsaminaceæ,* is a native of Java.

(4783.) The *Tropæolaceæ* are exclusively confined to South America. They are the natives of the more temperate parts of Peru and Chili; being found chiefly on the high lands when within the tropics.

(4784.) The *Geraniaceæ,* although not exclusively, are principally African plants, being found to prevail most at the Cape of Good Hope, from which place the beautiful *Pelargonia* have almost all been brought. This genus, however, is indigenous also to New Holland. In the northern hemisphere, the genera *Erodium* and *Geranium* supply the place of *Pelargonium, Monsonia,* and *Sarcocaulon;* for, although a few species of both are found at the Cape, in Australia, and in New Zealand, their principal range extends throughout Europe, Northern Asia, and North America. *Rhyncotheca,* indigenous in New Greneda and Peru, is the representative of the type in the southern parts of the western world, and the *Isopetala* are natives of St. Helena.

(4785.) Hence it would appear that, on the whole, the *Geraninæ* are the plants rather of the temperate and cooler parts of the equatorial regions, than of either the torrid or the frigid zones; their tendency, however, is decidedly more towards the equator than the poles.

(4786.) Malvinæ. Of the subsection *Malvianæ,* the *Malvaceæ* are plants which, if not peculiar to the tropics, occur most abundantly and grow most luxuriantly in the torrid zone, or the hotter parts of the temperate regions, and diminish rapidly both in number and in size towards the poles. One subtype, the *Bombacidæ,* including the *Adansoniæ,* those mammoths of the vegetable world, is almost exclusively confined to the intertropical latitudes; for the *Plagianthus* of New Zealand (a doubtful associate,) can scarcely be considered an exception. The East and West Indies, and continental Africa and America, within the torrid zone, are their principal habitat, but by far the greater number belong to the western hemisphere. The *Malvidæ,* although, like the associated subtype, decidedly affecting the tropics, still are abundant throughout the temperate regions, extending southwards to the Cape of Good Hope and New South Wales, and northwards throughout continental Europe into Britain, and even in a few instances into Siberia, as far as Moscow. The *Malvidæ* occur in nearly equal proportions in both the eastern and western hemispheres, but in the latter they seem to have a more tropical tendency than in the former.

(4787.) The *Bromaceæ,* like the preceding type, are chiefly found in the hotter parts of the world, and some of them have a decidedly tropical distribution. Thus the *Dombeyidæ* are natives of the East Indies, Ceylon, the Islands of Madagascar and Bourbon, and the Cape of Good Hope, in the Old World, and of Mexico and

the West Indies, in the New. Two species of *Melhania* are also indigenous to St. Helena. The *Hermannidæ* are found both in the West Indies and South America, as well as sparingly in the East Indies and in the islands of the Pacific; but more than two-thirds are African plants, and belong exclusively to the Cape of Good Hope. The *Lasiopetaleæ* of the *Buttneridæ*, which are very few in number, are wholly confined to New Holland; and their associates, the *Buttnerieæ*, although some of them Australian plants, and a few natives of the East Indies and the Moluccas, are principally found in the West Indies, and the southern parts of continental America, within, or just beyond the tropic; none of them are met with in extratropical North America. The *Sterculidæ*, on the contrary, are chiefly stationed in the eastern hemisphere, especially in India, China, and equinoctial Africa; in America they are rare, a few only occurring in Mexico, the West Indies, and South America.

(4788.) The *Tiliaceæ*, like the rest of the *Malvianæ*, have a tropical tendency. The *Dipterocarpidæ* are exclusively confined to Java, Sumatra, and the other islands of the East Indian Archipelago. The *Elæocarpidæ* are also for the most part East Indian plants, although some few examples are found in New Holland, New Zealand, and South America; none, however, occurring in the temperate regions north of the equator. While the *Tilidæ*, which, like both the associated subtypes, have in general an equatorial habitat, extend into the temperate zones of either hemisphere, being found in the East Indies, Java, Ceylon, Senegal, the Cape of Good Hope, and New Holland to the south; and Arabia, the northern parts of Africa, and most of the European countries to the north, in the eastern world; while in the western the range is equally extensive, although not so abundant in the West Indies as in continental America, both north and south. *Entelea arborescens*, the ant-arctic cork-tree, is a native of New Zealand.

(4789.) Of the subsection *Camellianæ*, the *Chlenaceæ* are all natives of Madagascar; the type is, however, very small, its 4 or 5 included genera containing only 8 or 10 known species. The *Theaceæ*, although not confined to equatorial latitudes, are the most frequent in the hotter parts of the world. Thus the *Ternströmidæ* are natives of Nepal, China, and Japan, in the eastern hemisphere; and of Jamaica, the Caraccas, Guiana, and Brazil, stretching however into North and South America, in the western world; while the *Camellidæ* are principally found in the East Indies and China.

(4790.) Hence, collectively considered, the *Malvinæ* are, by a great majority, the plants of warm climates; of the two subsections, the *Camellianæ* are the least scattered in their distribution, being found prevalent neither so directly under the line, nor extending so far northwards as the *Malvianæ*.

(4791.) Ranunculinæ. Of the subsection *Berberianæ*, the *Menispermaceæ* have a decidedly tropical distribution, prevailing, however, in the equatorial regions of Asia and America; but being, as far as our information extends, rare within similar latitudes in Africa. The East Indies, Ceylon, the West Indies, and Guiana, are the favorite habitats of the *Menispermidæ*, some of which, however, are found in Carolina, and even as far north as Canada, in the western, and Siberia, in the eastern hemisphere. The *Lardizabalidæ* are natives of Peru and Chili, and the *Schizandridæ*, of Carolina, and the southern states of North America.

(4792.) The *Berberaceæ*, on the contrary, are most prevalent in the temperate zone, and in the colder parts, even approaching, if not entering the arctic and antarctic circles; and, when in lower latitudes, affecting mountainous stations.

Thus, in the western hemisphere, they are found in Chili; and as far south as Terra Magellanica and Del Fuego; and as far north as Canada. While, in the eastern, they extend from the mountains of Nepal and China, to Siberia on the north; but south of the line they are not met with, being unknown in Australia, and absent from the whole of Africa; and none have hitherto been discovered in any of the islands of the Great South Sea, or the Southern Atlantic Ocean.

(4793.) Of the subsection *Ranunculianæ*, the *Anonaceæ* have equatorial stations, being found within the tropics of Asia, Africa, and America; the East and West Indies, Ceylon, Senegal, Guiana, and Cayenne, are their favorite habitats; sometimes, however, they extend into Florida, and a few other parts of North America.

(4794.) The *Magnoliaceæ* are peculiarly North American plants; for, although a few are found in the West Indies, and some have been discovered native in the East Indies and China, still their especial stations are the swamps of the Northwestern Continent. Not a single species has been met with in Africa, nor in any of its dependent islands.

(4795.) The *Dilleniaceæ* are the representatives of the *Magnoliaceæ* in Australia, more than half being natives of New Holland and the neighbouring countries. About one-fourth are natives of India and Southern Asia, and nearly as many of America within the tropics: very few have been found in Africa, and those in its equatorial parts, as at Sierra Leone, and on the banks of the Senegal; while in America the *Illicia* are natives of Florida, and *Drimys Winteri* is found at the southern extremity of that vast continent, being indigenous to Magellan's land.

(4796.) The *Ranunculaceæ* are the inhabitants of temperate zones, especially of the colder parts verging towards the polar circles. They are nearly equally distributed in the eastern and western hemispheres, but are much more prevalent in the northern than in the southern half of the globe. Thus in Europe and Northern Asia about one-fifth of the whole are found, and in North America about one-seventh, while in South America the proportion is not above one-seventeenth, and in Australia it is still less. They occur both in India and Africa, as in Nepal, Ceylon, Sierra Leone, Japan, and the Cape of Good Hope, but when within the tropics they seek alpine stations, and very few are found either in Africa or Asia, excepting in their northern parts, extending through Siberia into Kamtschatka, on the north-eastern limit, and into New Zealand in the south-western extremity of the world.

(4797.) Of the subsection *Nelumbianæ*, the *Pæoniaceæ* are inhabitants chiefly of the temperate or north temperate regions. The *Pæonidæ* extend from China through Tartary and the Levant, into Europe and Siberia; and are found likewise in the northern parts of America. The *Cabombidæ*, which are aquatic plants, although most common in the northern states of America, extend from New Jersey through Carolina to Cayenne. These latter are exclusively found in the western hemisphere; the former are natives of both worlds.

(4798.) The *Nelumbiaceæ* are tropical water plants, indigenous to either hemisphere, but found most abundantly in the East Indies and China. Like other aquatics, although the type contains but a single genus, its species have a license of latitude. They used to be common in Egypt, but are now rare in the waters of the Nile, although still frequent in those of the Volga. They are also found in the West Indies and America, but are not met with south of the equator.

(4799.) The *Nymphæaceæ*, which are very similar to the *Nelumbiaceæ* in habit and structure, have likewise a very similar distribution; they are found in the East and West Indies, and are met with in the waters of most countries north of the equator, as far as Scotland and Siberia in the eastern world, and Canada in the western. They are also indigenous to the Cape of Good Hope, which is their only habitat in the southern hemisphere.

(4800.) Hence, collectively considered, the *Ranunculinæ* are the plants of the temperate and colder regions of the globe, and especially of those of the northern hemisphere; and, in the majority of those instances which would seem as to latitude to be exceptions to the general rule, the plants still maintain its integrity by their stations, either flying to the altitude of the mountains, or to the reduced and more equalized temperature of the water.

(4801.) RHÆADINÆ. The *Sarraceniaceæ*, including only the several species of the single genus *Sarracennia*, have a very limited habitat. They are all natives of the bogs and swamps of North America, and are unknown in any other parts of the world.

(4802.) The *Papaveraceæ* are especially European plants, more than two-thirds of those known being indigenous to its several parts, and scarcely any extend even into the contiguous districts of Asia in similar parallels. Two species alone, according to De Candolle, are peculiar to Siberia, but some European ones are indigenous to Asiatic Russia; and *Papaver microcarpon* is a native of Kamtschatka. North America is the next favorite habitat of the *Papaveraceæ;* but even in its extratropical regions they are much less abundant than in Europe, and within its tropics only six are found. This distribution finds a parallel in the eastern hemisphere, for but three have been discovered in China and Japan; a single species is all that Southern Africa affords, and New Holland can boast of only one.

(4803.) The *Fumariaceæ*, like their allies, the *Papaveraceæ*, are natives of the cold and temperate regions of the northern hemisphere. Siberia, Kamtschatka, and Canada, are their favorite habitats. Some, however, stretch to the south of Europe; and three species have been found at the Cape of Good Hope, two of which are perhaps but varieties of the European *Fumaria officinalis* and *F. capreolata*.

(4804.) The *Brassicaceæ* or *Cruciferæ* form another decidedly European group: they are most abundant through the whole extent of that quarter of the world, from Norway and Lapland, to the Levant and the shores and islands of the Mediterranean. Their relative and absolute numbers rapidly decrease in all the lower latitudes; and, although found on the northern shores of Africa, in Syria, and Asia Minor, China, Japan, and the East Indies, their proportions get gradually less and less: in equinoctial Africa they are unknown, but in the southern hemisphere beyond the tropics, *i. e.* at the Cape of Good Hope and in New Holland, they again appear, and in number far exceed those which are found in the peninsula of Hindustan. In the Western hemisphere, although far less abundant, they maintain a similar distribution, extending from the arctic circle, from Baffin's Bay, Melville Island, and Greenland, through North America, to the West Indies, where, however, their number is reduced to two; and again increasing in its south temperate zone, being found in Patagonia, and also in New Zealand. From the computation of De Candolle, of about 900 or 1000 species, upwards of 800 belong to the northern

hemisphere, and only about 100 to the southern; of these upwards of 200 are found in the north frigid zone, and between 6 and 700 in the north temperate regions, leaving a very small quota indeed for the rest of the world; and it appears, from further calculations, that about 90 are indigenous to the south temperate zone, and only found within the tropics; and even these are for the most part confined to the mountainous districts.

(4805.) The *Capparidaceæ* are almost exclusively tropical plants, or confined to the hotter parts of the temperate regions. The *Capparidæ* are most abundant in Africa, the *Cleomidæ* most prevalent in other parts of the torrid zone, but examples of both subtypes are found in the East and West Indies. Ceylon, Madagascar, Senegal, Sierra Leone, the Cape of Good Hope, Jamaica, Brazil, and the Caraccas, are their favorite habitats; but they are also found in Egypt and Arabia, and in several parts of North and South America; one species, *Polanisia graveolens*, occurring native as far north as Canada, although the south of Europe is the highest latitude in which they are found in the eastern world; and this is attained only in the case of *Capparis spinosa* and *Cleome violacea*, which latter is indigenous to Portugal.

(4806.) The *Resedaceæ* are almost peculiar to Europe, especially to its middle and southern parts. Several species, however, are found in Asiatic and African countries bordering on the Mediterranean, as in Egypt and Palestine, and one is mentioned as being a native of China. They are wholly absent from the western hemisphere, and but one is known south of the equator, viz. *Reseda dipetala*, which is found at the Cape of Good Hope.

(4807.) The *Polygalaceæ*, though few in number, are very widely scattered over the surface of the globe, being found in both hemispheres, and in every zone of either world. Perhaps their chief seat is the Cape of Good Hope, but several are also stationed in North America; and others are met with in South America and the West Indies, three or four in Europe as far north as Britain, 2 or 3 in China, and three or more species of the Brazil genus, *Comesperma*, are found in New Holland, to which country the allied *Tremandraceæ* are exclusively confined.

(4808.) If number of genera and species, or the prevalence of individuals, be admitted as criteria to determine the predominant distribution of any series of natural families, the section *Rhœadinæ* has most eminently a northern range. Of all the flowering orders these types contain plants which nearest approach the pole in the greatest numbers, and luxuriate in the frigid zone, almost on the boundaries of perpetual snow. They are hence, on the average, to be esteemed as belonging peculiarly to the north temperate and frigid zones.

(4809.) RUTINÆ. The *Amyridaceæ*, which are very few in number, are, with the exception of *Amyris Floridana*, which is found in the most southern of the United States, exclusively tropical plants; being nearly equally divided between the two hemispheres, but rather predominating in the western. The East and West Indies and Continental America within the torrid zone, are their favorite habitats.

(4810.) The *Olacaceæ* have likewise in general an equinoctial range, being found both in the East and West Indies, and in Continental America within the tropics, but they are also found in Africa and in New Holland.

(4811.) The *Aurantiaceæ* are natives of warm countries, and, although not decidedly tropical, yet are met with most abundant and luxuriant in the northern parts of the equatorial regions, and the southern ones of the north temperate

zone. The East Indies, China, and Japan, are their principal habitats, but they are found in other parts of Asia, in the Island of Madagascar, in the West Indies, and in Brazil, and they are almost naturalized to the southern parts of Europe.

(4812.) Of the *Rutaceæ* the *Zygophyllidæ* are curiously scattered over various parts of the Old and New Worlds. The genus *Tribulus* is found within the tropics, or in countries bordering on them in both hemispheres, being a native of Thibet and Jamaica, and extending both into South America and the South of Europe. The *Fagoniæ* are spread over the south of Europe and the Levant. The *Zygophylla* are indigenous to Northern and Southern Africa, Syria, Siberia, and Mexico. *Melianthus* occurs both in the East Indies and in New Holland; but *Guiacum*, with the small genera, *Larrea* and *Porliera*, are exclusively confined to the West Indies and Continental America.

(4813.) The *Rutidæ* are distinguished into three subtypical districts, the geographical distribution of each of which is worthy of separate attention. (1°.) The *Ruteæ* are natives of the southern parts of Europe, and of Levantine Africa and Asia, rarely being met with within the tropics. *Ruta albiflora* is, however, indigenous in Nepal. (2°.) The *Diosmeæ*, as before described [§ 4016], are systematically formed into four or five minor groups, and their structural peculiarities are curiously coincident with their geographical distribution. Thus the *Dictamneæ* are natives of the south of Europe. The genuine *Diosmeæ* are almost exclusively confined to the Cape. The *Boronieæ* are Australian *Diosmeæ*; and the *Pilocarpeæ* and *Cuspariæ* are as exclusively American, being chiefly natives of the West Indies and the neighbouring continent, some also occurring in New Zealand and the Friendly Isles. (3°.) The *Zanthoxyleæ* are for the most part natives of the equinoctial regions of Asia and America, especially the latter. In Continental Africa they are scarce, but are found in the Isles of France and Madagascar; and one is indigenous to New Holland.

(4814.) The *Simarubidæ* are altogether tropical in their distribution; they are found in the West Indies and Guiana, in Continental Africa, and in Nepal.

(4815.) The *Ochnaceæ* are formed of two subtypes; of these the *Ochnidæ* have a decidedly equatorial range: they are found in the East and West Indies, at Sierra Leone, in Madagascar, Guiana, and Mexico; thus flourishing only in the hottest parts of the world; while the *Coriaridæ*, although most prevalent within the tropics, as in Peru and Mexico, are also found in the north of Africa, the south of Europe, and even in New Zealand.

(4816.) The *Rutinæ* form therefore, collectively considered, a section which predominates within the tropics, or in the hotter parts of the temperate zones, never in any instance approaching the arctic or antarctic circles.

(4817.) Acerinæ. Of the *Sapindaceæ*, essentially a tropical group, the *Sapindidæ* are chiefly (though not exclusively) found in the eastern, and the *Paullinidæ* in the western hemisphere. The *Dodonidæ* occur sparingly where the two previous types are the most common, and prevail in New Holland, where the others are unknown. Europe and North America beyond the tropic are wholly without examples of this type.

(4818.) Of the *Æsculaceæ*, the *Rhizobolidæ* are exclusively natives of South America within the torrid zone; while the *Hippocastanidæ* are found in the temperate parts of Northern India, whence they have spread into the Levant; but the greatest number are found in the north temperate regions of America.

(4819.) The *Aceraceæ* follow nearly the distribution of the *Æsculaceæ*, but have rather a more northern range; they are found to prevail from India, China, and Tartary, to Britain, and throughout the greatest part of North America; but they are absent from Africa, and none are known south of the line in either hemisphere.

(4820.) The *Malpighiaceæ* are equinoctial plants, and almost peculiar to the western world. In Africa and Asia, even within the torrid zone, they are rarely met with: one is found in Arabia, but in Europe and Australia they are unknown.

(4821.) The *Hippocrataceæ* are likewise chiefly West Indian and South American plants, a few only having been discovered in Africa and Asia, as in Sierra Leone and in the East Indies; but from Europe and Australia they are wholly absent.

(4822.) The *Brexiaceæ*, including only the very few known species of the solitary genus *Brexia*, are confined exclusively to Madagascar.

(4823.) Hence, on the average, it appears that the *Acerinæ* are for the most part natives of the warmer parts of the temperate regions, tending rather to the equator than to the northern or southern zone.

(4824.) Should an average be attempted of the distribution of the Rosales in general, it would be liable to so many exceptions as scarcely to be worth enunciating; they are, however, manifestly less northern in their range than the *Querneales*, and they seem to predominate within the tropics and in the hotter regions of the temperate zones.

SYRINGALES.

(4825.) *Rubiacinæ*. The *Caprifoliaceæ* are plants peculiarly belonging to the north temperate zone, and tending more towards the frigid than the torrid zone. Some few are found in Nepal and China, in the north of Africa, the islands of the Mediterranean, the Levant, and the West Indies, but the majority belong to North America and Europe, extending as far north as Canada and Siberia.

(4826.) The *Cinchonaceæ* are chiefly tropical in their distribution; they are natives both of the eastern and western hemispheres. The East and West Indies, the Cape of Good Hope, Sierra Leone, the Isle of Bourbon, Madagascar, the Bahamas, China, and Arabia, are their favorite haunts. Some however extend northwards and southwards into the United States of America and Terra Magellanica, and they are also found both in New Zealand and New Holland. The *Rubiaceæ*, intimately allied to the *Cinchonaceæ*, and often considered as forming a part of that group, represent them in the more northern parts of the world, from which the others are wholly absent.

(4827.) Hence, collectively considered, the *Rubiacinæ*, although very widely spread, and extending even towards polar latitudes, are in the vast majority of instances tropical plants, or natives of the hotter parts of the temperate zones, bordering on the equatorial regions.

(4828.) Valerinæ. The *Valerianaceæ* are natives of temperate latitudes; they are common throughout Europe, and are found even in high latitudes, and at considerable altitudes; they occur in the Levant, and are frequent in the north of India. Some are found at the Cape of Good Hope, but they are rare in Africa, and likewise seldom met with in North, although common in South America.

(4829.) The *Dipsaceæ* are more particularly the plants of the south temperate regions, especially of the eastern hemisphere north of the line; and, unlike the *Valerianaceæ*, they are not met with in high latitudes, or at any considerable altitudes. *Morina*, of the *Morinidæ*, is a native of Persia. The *Scabiosidæ* are principally spread over the southern parts of Europe, the northern ones of Africa, and the Levant, extending even to the East Indies, Cochin-china, and the Cape of Good Hope, but they are very rare in the western world.

(4830.) Hence it is evident that the *Valerinæ* are the denizens of temperate climates, with a polar rather than an equatorial tendency.

(4831.) Asterinæ. The *Calyceraceæ*, which are little more than a deviating group of the *Asterianæ*, need scarcely be distinguished as to their distribution from the rest of the *Compositæ*, were it not that they are altogether South American plants. The *Asterianæ* are widely distributed, and they are scattered in no very regular proportions through diverse latitudes. It is however manifest that the *Asteraceæ* are most prevalent within the tropics and in hot countries; while the *Cynaraceæ* are most abundant in the temperate regions, and the *Cichoraceæ* and *Mutisiaceæ* in the cold ones; the former most frequent in the northern, and the latter in the southern hemisphere: the *Mutisiaceæ* indeed appearing to be the representatives of the *Cichoraceæ* in the higher latitudes of South America, especially from Peru to the Straits of Magellan, although some are found in Mexico and the West Indies; and *Perdicium* is a native of Siberia. From the collections made in Africa the *Compositæ* do not seem to be so numerous, at least on its western coasts, and at the Cape, as in the other continents; and in the northern parts of New Holland their ratio is also small. One other generalization is remarkable; for, while in the cold and temperate zones, the *Compositæ* are herbaceous plants, rarely, as in the burdock and some *Artemisiæ*, becoming suffrutescent, they gradually assume a shrubby, and even an arboreous port, as they approach the equator: thus the Chilian *Asterianæ* are for the most part bushes, and in the Island of St. Helena the most common trees belong to this natural group.

(4832.) Humboldt, Brown, and others, have made some laborious calculations as to the relative proportions which the *Compositæ* hold to other flowering plants, in various parts of the world. Thus, in Lapland, they form $\frac{1}{15}$, in France $\frac{1}{7}$, in Germany $\frac{1}{8}$, in Sicily upwards of $\frac{1}{2}$, in North America $\frac{1}{6}$, about the same in equal latitudes in Europe: but in tropical America increasing, as in Sicily, to $\frac{1}{2}$: in Melville Island $\frac{1}{16}$, but in the northern parts of New Holland only $\frac{1}{23}$. Hence it would appear that, collectively considered, the *Asterinæ* predominate, in their relative proportions to other flowering plants, within the tropics and in the countries bordering thereon, at least in the northern hemisphere, and that their ratio is the lowest within the arctic circle, and in the colder parts of the north temperate zone. New Holland, within the tropics, is, however, an exception, as there the proportion is considerably less than either in Lapland or in Melville Island.

(4833.) Campanulinæ. The *Goodeniaceæ* and *Stylidiaceæ*, both nearly related to the *Asterinæ*, are almost exclusively confined to New Holland and the Australian Islands; thus, perhaps, supplying the place of the preceding section. Some, as a few species of *Scævola*, have been found in the East and West Indies, but they are very rarely met with beyond the Australian dependencies.

(4834.) Of the *Campanulaceæ*, the *Lobelidæ* are decidedly the plants of hot climates, and the *Campanulidæ* those of cold ones. The former are most abundant in the West Indies and Continental America within the tropics, the Sandwich Islands, and the Cape of Good Hope. They are also found in the East Indies and China, and hence stretch northwards into Britain, and southwards into New Zealand, but examples of them get more and more rare in a direct ratio to the distance from the equator; while the *Campanulidæ* prevail in the north temperate zone. These latter are found in Northern Asia and Europe, as in Lapland, Siberia, Scotland, and the alpine regions of France and Switzerland, as well as in North America, but their especial range in the northern hemisphere is between the 36th and 47th degree; on either side of this zone they diminish, but most rapidly towards the equator, only nineteen species being known within the tropics. In the southern hemisphere they again prevail at the Cape of Good Hope in latitude 34° south, but the genera are for the most part different from those of Europe. In South America and Australia but few are found, their place being supplied in the latter by the *Goodeniaceæ*.

(4835.) Although the *Goodeniaceæ* and *Stylidiaceæ*, with the *Lobitidæ* of the *Campanulaceæ*, have a decidedly tropical range, yet, since the *Campanulidæ* contain more known genera than all the others combined, this section must be regarded as rather affecting temperate than warm climates: but with a tendency rather towards the equator than the poles.

(4836.) Ericinæ. The *Vacciniaceæ* prevail in the cold temperate latitudes of the northern hemisphere, approaching, and even entering the arctic circle. In the middle and southern parts of the temperate zone they are scarce, and within the tropics hardly known. The northern parts of Europe and America are their principal stations, but they are also met with on the high lands of the Sandwich Islands, thus approaching the antarctic circle.

(4837.) Of the *Ericaceæ*, the *Pyrolidæ* have a northern distribution, being principally indigenous to the northern part of Europe and Asia, and North America, and absent from, or not as yet met with, in the southern hemisphere. The *Ericidæ* are common all over the world, excepting in Asia and Australia. In the latter they are almost unknown, and in the former scarce. Their head-quarters are at the Cape of Good Hope, where they are found in extraordinary profusion. They are also frequent both in North and South America, in the forms of Rhododendra and Azaleæ; but still insignificant in their numbers, if compared to the Ericæ of the Cape.

(4838.) The Epacridaceæ, which would seem to be the heaths of Australia, supply the place of the Ericæ in New Holland, New Zealand, and the Polynesian Isles, where they are exclusively found, and throughout which they are as abundant as the Ericæ at the Cape; and it is remarkable, as before observed, that in the countries of the *Epacridaceæ* the Ericæ are scarcely known, although the ormer are not abundant in every region from which the latter are absent.

(4839.) The *Ericinæ*, collectively considered, are perhaps, on the whole, predominant rather in the warm temperate regions than either within the tropics or towards the poles, although several are equatorial in their habitats, and not a few have an arctic and antarctic tendency.

(4840.) Styracinæ. The *Styraceæ* are natives of the south of Europe, of China, and Nepal, and of America, both within and without the tropics. In

Africa and Australia they are unknown, while the *Belvisiaceæ* are exclusively found in Africa; and the *Sapotaceæ*, in the South Sea Islands, as well as in India, Asia, Continental and Insular Africa, and both North and South America. But from Europe and Northern Asia they are altogether absent.

(4841.) The *Ebenaceæ* are likewise chiefly prevalent in the East and West Indies, Ceylon, Japan, and the Cape of Good Hope; some, however, are met with as far north as Virginia and New York in America, and Switzerland in Europe. Thus, collectively considered, the *Styracinæ* are most prevalent in the torrid zone and the hotter parts of the temperate regions, none of them tending towards the poles.

(4842.) MENTHINÆ. The *Gesneriaceæ* are natives of the West Indies and Continental America, within the tropics. They are exclusively confined to the equatorial parts of the western hemisphere, and are unknown in any other parts of the world. The *Orobanchaceæ*, on the contrary, which are nearly related to them, however different they may seem in habit, are common to both worlds, but are most prevalent in the south temperate regions of the northern hemisphere. In India and Southern Africa they are rare, and mention is not made of them in the catalogues of Australian plants.

(4843.) The *Acanthaceæ*, although not exclusively tropical in their distribution, are natives only of the torrid zone, or of the hotter parts of the extratropical regions. The East and West Indies, Ceylon, Madagascar, the Cape of Good Hope, and Continental Africa and America, under the line, are the favorite stations of the *Acanthidæ*. A few are found in China and the south of Europe, but their number is small. The *Cyrtandridæ* and *Sesamidæ* have a still more decidedly equinoctial range, the former being wholly confined within the tropics of the eastern hemisphere; while the latter, although present in both hemispheres, are scarcely known, except in Egypt without the limits of the torrid zone.

(4844.) The *Bignoniaceæ* have likewise an equinoctial tendency. They occur within the tropics of either hemisphere, and are principally met with in the East and West Indies, China, Madagascar, Mexico, and Guiana. In America they extend northwards and southwards into Pennsylvania and Chili, but in the eastern hemisphere they are unknown in Europe, although natives of New Holland and New South Wales.

(4845.) Of the *Verbenaceæ*, the *Selaginidæ* are all natives of Africa, and exclusively found at the Cape of Good Hope. The *Myoporidæ* are chiefly Australian plants, few being found either in Asia, Africa, or America, and there only within the torrid zone, although in Van Dieman's Land they are common, and several are natives of the Sandwich Islands. In Europe they are unknown. The *Verbinidæ* likewise are chiefly met with in tropical latitudes; in the East and West Indies, Ceylon, Java, Japan, Sierra Leone, Guinea, and Guiana, they are common. In South America they extend into the temperate regions, but in North America and Europe they are rare; and our *Verbinidæ* are insignificant herbs, while those of Africa and Nepal are majestic forest-trees.

(4846.) The *Menthaceæ* or *Labiatæ*, although not tropical plants, and having their predominant range in the north temperate zone, are chiefly found in its southern, or in its hotter and drier parts. Many are indigenous within the tropics, but the majority are met with between the 40th and 50th degrees of north latitude, their proportion becoming less on either side, but more especially diminishing

towards the pole than towards the equator. In marshy localities and in the northern regions they are rare: from Melville Island they are altogether absent.

(4847.) The *Utriculariaceæ* are the representatives of the *Menthaceæ* in wet and swampy situations, and, like many other aquatics, they are found in most parts of the world.

(4848.) The *Scrophulariaceæ* are remarkable for their very wide diffusion. They are met with everywhere, and almost everywhere in abundance, even from the equator to the poles. In the torrid zone of either world they are abundant; but perhaps more common in the temperate regions of either hemisphere, extending southwards into New Holland, New Zealand, Terra del Fuego, and the Falkland Isles; and northwards into Canada, Siberia, Greenland, and Melville Island. The *Rhinanthidæ* have a less tendency either towards the equator or the poles than the *Scrophularidæ*, and are principally met with in the temperate zones both of the northern and southern hemispheres.

(4849.) The *Menthinæ*, collectively considered, can scarcely be said to predominate in either zone, for the equatorial prevalence and the tropical tendency of the three or four first named types, is compensated by the polar range of the latter, and the intermediate distribution of the large group Menthaceæ.

(4850.) Solaninæ. The *Solanaceæ* have for the most part a tropical range, or, when extratropical, they are distributed through the warmer parts of the temperate zones, their numbers being in an inverse ratio to the latitudes in which they are found; and none are known within, and few observed to approach the frigid zones. Of the four subtypes, the *Verbascidæ* have the most northern tendency; for, although the several species of *Anthocercis* are natives of New Holland, and the *Celsiæ* are found in the East Indies, Barbary, and the Levant, the large genus Verbascum is wholly extratropical, extending from the shores of the Mediterranean even to Siberia; a solitary species or so being alone indigenous in Nepal. In the torrid zone the *Solanidæ* occur in vast profusion. The East and West Indies, Guinea and Guiana, indeed, the equatorial regions in all their amplitude, including the hotter parallels of the zones on either side, are richly furnished with the various genera and species of this important group. The *Solanidæ*, however, are rather more prevalent in the western world than in the eastern, which is the reverse of the *Verbascidæ*, and both are more common in the northern than in the southern hemisphere. Of the *Nolanidæ* and *Cestridæ* little need be said; the *Nolanæ* are natives of Chili and Peru, and the *Cestra* are found within the tropics of both halves of the globe.

(4851.) The *Polemoniaceæ* are almost the reverse of the *Solanaceæ* in their geographical distribution, for in temperate regions, especially in those of the north-western continent, they abound, while, within the tropics, they are unknown. They are much less abundant in Europe and Asia than in America, where they extend as far north as Canada. In the southern hemisphere they are comparatively scarce.

(4852.) The *Convolvulaceæ* are in the main equatorial plants, their maximum being within the tropics, and their number gradually decreasing north and south as the latitudes increase. Although present and well known, they are comparatively few even in the temperate parts of Europe and North America, but in the colder parallels they are very seldom found. In Asia, Australia, Africa, and America, within the tropics, they are most abundant; Sierra Leone, Senegal,

Madagascar, and the islands of the East and West Indian Archipelagos, are their favorite habitats. The *Cuscutidæ*, bearing in mind their much smaller number, seem to be as widely diffused as the *Convolvulidæ;* for they extend from Nepal to New Holland, and from Cochin-china to Siberia, in the eastern hemisphere, and in the western they are found in Brazil, Mexico, Peru, and Chili, as well as in other parts of North and South America.

(4853.) The *Hydroleaceæ*, although few in number, are widely scattered over the globe, appearing at intervals in every zone. Thus *Wigandia* and *Næma* are intertropical plants; the *Hydroleæ* are found both within and without the tropics, and in both the eastern and western worlds; while *Diapensia* is a native of Lapland.

(4854.) The *Boraginaceæ* are the especial plants of the temperate regions, and they are found in either hemisphere, and in either world. The *Boraginidæ* are principally found in the south of Europe, the north of Africa, and Levantine Asia; in the north of Europe they are less abundant than in the south, and in the western less common than the eastern hemisphere. Within the tropics they are almost unknown; some are found in Peru, at the Cape of Good Hope, in Ceylon, and in New South Wales; but on the whole they are less frequent south than north of the equator.

(4855.) The *Hydrophyllidæ* are in one respect the reverse of the *Boraginidæ*, as they are wholly American plants; but they agree with their associates in being found chiefly in the temperate regions. They occur both in Canada and in Terra Magellanica, with very few intervening habitats; one species, however, is a native of Virginia, and another of Peru.

(4856.) Of the *Heliotropidæ*, which are separated into several districts, the *Cordieæ* and *Ehretieæ* have an exclusively tropical range, being found in both hemispheres, but only within the torrid zone; and the *Heliotropieæ*, although not strictly equinoctinal plants, are rarely found without the tropics, except in the hotter parts of the temperate zones.

(4857.) The *Solaninæ*, collectively considered, have decidedly rather an equatorial than a polar range; for, although many are found in the temperate regions, they are in general natives of their warmer parts.

(4858.) Gentianinæ. Of the *Gentianaceæ*, the *Spigelidæ* are natives of America, and chiefly confined to the southern tropic, extending however as far north as Maryland. The *Menyanthidæ*, on the contrary, have rather an extratropical range, being natives of North America, the north of Europe, and New South Wales; a few, however, are found in the East Indies and at the Cape of Good Hope; while the *Gentianidæ* are almost equally diffused all over the world, and almost equal in their proportions in its hottest and its coldest parts. They are found in the West Indies, in Canada, and near the Straits of Magellan, on the sandy shores of Mexico and in the Levant, on the alps of Switzerland, and in the deserts of Siberia. At the Cape of Good Hope they are abundant, and in Nepal and New Holland they are not unknown. Melville Island is perhaps the only place from which they are wholly absent.

(4859.) The *Strychnaceæ* are most prevalent within the tropics, or in the hotter regions of the temperate zones immediately contingent. The *Stapelidæ* seem to have fixed their head-quarters at the Cape of Good Hope, where a vast proportion both of their genera and species are found. They are also natives of

the Asiatic and American continents within the tropics, and of the islands in similar latitudes; some, however, are met with in China and Egypt, and even in Siberia, as well as in Florida and Carolina. The *Asclepiades*, indeed, are exclusively the plants of the north-eastern states of America, as the *Stapelidæ*, and several other genera, are of the Cape of Good Hope. *Cynanchum* has an extraordinary extent of range, being found both in Siberia and at the Cape, *i. e.* in latitudes 50° north and 32° south.

(4860.) The *Apocynidæ* have likewise a tropical range, but they are less exclusively found in any especial places, and more equally diffused throughout the equatorial regions. Although found at the Cape of Good Hope and in North America, they are not more predominant in either place than in the East and West Indies, Ceylon, China, New Holland, or Continental America within the tropics. The *Vincæ* are natives of Britain and Madagascar, an extensive range, but considerably less than that of the *Lycia*.

(4861.) Of the *Loganiaceæ*, the *Potalidæ* are found in equinoctial Asia, Africa, and America. The *Loganidæ* likewise prevail in the tropical parts of America, and in the temperate ones of Australia; *Pegainieæ* representing the subtype in Brazil, and the *Loganieæ* in New Holland. From the colder parts of the temperate zones they are altogether absent.

(4862.) Hence it would appear that the *Gentianinæ* are most prevalent within the tropics, or in the scarcely extratropical regions of the temperate zones.

(4863.) Primulinæ. Of the *Oleaceæ* the *Columellidæ* are natives of Mexico and Peru; while the *Jasminidæ* are diffused throughout tropical Asia; Java, Sumatra, and Hindustan, are their principal habitats; some are also found in New Holland and at the Cape of Good Hope; but they are almost absent from the western hemisphere, and are scarce in the temperate zones of either world; while the *Fraxinidæ* are rare in the torrid zone, prevailing most in the temperate latitudes, but in their warmer rather than in their colder regions.

(4864.) Of the *Primulaceæ*, the *Myrsinidæ* are natives of the American, Asiatic, and Australian tropics, but not of the equatorial parts of Africa, although they are met with at the Cape of Good Hope and in the Canaries; *Myrsine retusa* is indigenous in the Azores, and *Jacquinia aurantiaca* to the Sandwich Islands, both being exceptions to the general rule which enunciates the tropical distribution of this subtype. The *Primulidæ* are the representatives of the *Myrsinidæ* in the temperate regions, and within the frigid zone, as these are of those in the tropics. The *Primulidæ* abound in the colder regions of the temperate zones, and grow often on the highest lands, braving the rigors of an alpine or an arctic winter. The *Douglassiæ*, which are the gems of the rocky mountains of North America, have been found in blossom beneath the snow. In Spain, Italy, and the Levant, their number is less than in higher latitudes; and within the tropics they are rare even as mountain-plants.

(4865.) Hence the *Primulinæ* would appear on an average to be nearly equally present both in the hot and frigid zones, for, although three of the minor groups have an equatorial, two, which are larger, have a temperate or polar tendency.

(4866.) Plantaginæ. The *Plantaginaceæ* have a remarkably extensive range. They are found native in the most distant countries, as in Kamtschatka and at the Cape of Good Hope; in Patagonia, Mexico, and Canada; particular local habitation they have none.

(4867.) The *Plumbaginaceæ* are almost, or altogether as widely diffused as the genera of the preceding type. They are found in Ceylon, New Holland, the Levant, and Siberia; Gibraltar, Barbary, and the Cape of Good Hope; North America, Mexico, the West Indies, and Cape Horn.

(4868.) The *Globulariaceæ*, which connect this section to the *Asterinæ*, are natives of the southern parts of Europe, and are wholly confined to the northern half of the eastern hemisphere.

(4869.) Such perfect cosmopolites are the *Plantaginæ*, that they defy any average of their prevalent distribution to be made. This however is evident, that they have no tropical tendency, except in the case of the small group *Globulariaceæ*, which not only agrees with the *Asteraceæ* in structure, but approaches in its distribution their prevalent range.

(4870.) From the preceding details, it is probable, making every allowance for numerous exceptions, that the *Syringales* have, on the whole, a more decidedly tropical tendency than either of the preceding orders, very much more so than the *Querneales;* and perhaps, their number being taken into the estimate, very notably more so than the *Rosales*. The exceptions are however so numerous to such general statements, that practically they become of little worth. The distribution of the types is the most important part of the enquiry, and happily it is that which is the most attainable, and the least subject to error.

(4871.) As a sequel to the foregoing summary of the special diffusion of the numerous types and sections of the *Rosures* throughout the earth, it may be well to reverse the scheme of contemplation, and take a similar conspective glance in succession at the prevalent vegetations of either zone. In the former view, the stations and habitats of the many natural groups have been traced; in the present, it is proposed to examine, not the statistics of vegetables in general, but the relative and absolute proportions in which these plants occur in the various zones or climatorial regions, and the forms which are prevalent in each.

(4872.) It can never be too often repeated, that although, as a general rule, the heat and light enjoyed by the various countries spread throughout the several zones gradually and regularly decrease from the equator to the poles, and are in an inverse ratio to the latitude, still that altitude, distance from the seas, or proximity to large bodies of water, and even the course taken by the mountain chains, vary very materially the temperature, and affect the climate of many countries; and of these modifying causes, the effects are never more obvious than in the vegetation that prevails. Hence, as Humboldt observes, the geographical belts, or isothermal lines, are not accordant with the parallels of latitude; and many of those instances which seem to be exceptions to the characteristic distribution of certain families of plants, will be found, upon examination, to be exceptions only to strict geographical latitude, and not to climate; so that, when polar vegetables are found within the tropics, or tropical plants wander from the torrid zone, it is very often only when equinoctial heats are found without the tropics, or when elevation brings a polar temperature within them.

(4873.) Considering the general statistical distribution of the *Rosares*, with reference to each of the great zones, the following will be found to be equatorial groups, or to have tropical tendency.

1°. of the QUERNEALES. The Artocarpidæ, Aquilariaceæ, Chailletiaceæ, Lacistemidæ, Lauraceæ, Myristicaceæ, Terminaliaceæ, Trapaceæ, Piperaceæ,

Chloranthaceæ, Nepenthaceæ, Aristolochiaceæ, Nyctaginaceæ, Amarantidæ, Begoniaceæ, and Euphorbiaceæ.

2°. of the ROSALES. The Cassuviaceæ, Spondiaceæ, Connaraceæ, Mimosianæ, Chrysobalaneæ, Myrtaceæ, Gustaviaceæ, Memecylaceæ, Melastomaceæ, Combretaceæ, Vochyaceæ, Rhizophoraceæ, Fouquieriaceæ, Mesembraceæ, Nopalaceæ, Samydaceæ, Homaliaceæ, Passifloraceæ, Turneraceæ, Papayaceæ, Cucurbitaceæ, Loranthaceæ, Leeaceæ, Meliaceæ, Garciniaceæ, Flacourtiaceæ, Marcgraviaceæ, Bixaceæ, Polygalaceæ, Hydrocereæ, Malvaceæ, Chlenaceæ, Theaceæ, Bromaceæ, Tiliaceæ, Memispermaceæ, Anonaceæ, Nelumbiaceæ, Capparidaceæ, Polygalaceæ, Amyridaceæ, Olacaceæ, Simarubidæ, Ochnaceæ, Sapindaceæ, Rhizobolidæ, Malpigiaceæ, Hippocrateaceæ, and Brexidæ.

3°. of the SYRINGALES. The Cinchonaceæ, Asteraceæ, Lobelidæ, Styraceæ, Belvisiaceæ, Sapotaceæ, Ebenaceæ, Gesneriaceæ, Acanthaceæ, Bignoniaceæ, Verbenaceæ, Solanidæ, Nolanidæ, Cestridæ, Convolvulaceæ, Heliotropidæ, Spigelidæ, Strychnaceæ, Loganiaceæ, Columellidæ, Jasminidæ, and Myrsinidæ.

(4874.) Those groups which have a circumpolar distribution, or even a tendency towards the frigid zones, are to the foregoing comparatively insignificant in number. Among the *Querneales* are found only the Myricaceæ, Betulaceæ, Salicaceæ, Corylaceæ, Ceratophyllaceæ, Chenopodidæ, and Empetraceæ. Among the ROSALES, the Circæaceæ, Saxifragaceæ, Corneaceæ, Dianthaceæ, Aceraceæ, and part of Ranculaceæ, Pæoniaceæ, and Umbelliferæ; and among the Syringales, part of Cichoraceæ and Mutisiaceæ; with the Campanulidæ, Vaccinidæ, Pyrolidæ, and Primulidæ.

(4875.) The natural families which prevail in the temperate zones have a more or less constant tendency either on the one side or the other towards the equator or the poles; and some groups, already enumerated as having a tropical or polar range, might also, from their prevalence in these regions, perhaps, be repeated here without much impropriety. Such as the Chenopodidæ, Tiliaceæ, Verbenaceæ, Caprifoliaceæ, Mutisiaceæ, Cichoraceæ, &c. But the following constitute the prevailing flora in different parts of the temperate zones. 1°. Of the QUERNEALES. The Casuarinaceæ, Platanidæ, Ulmaceæ, Datiscaceæ, Monimiaceæ, Thymelæaceæ, Proteaceæ, Penæaceæ, Saururaceæ, Scleranthaceæ, and Phytolaccidæ. 2° of the ROSALES. The Aquifoliaceæ, Celastraceæ, Rhamnaceæ, Bruniaceæ, Lotianæ, Amygdalidæ, Rosaceæ, Spiræaceæ, Sanguisorbaceæ, Punicaceæ, Lythraceæ, Onagraceæ, Hydrangeaceæ, Hamameliaceæ, Portulaceæ, Crassulaceæ, Grossulaceæ, Malesherbidæ, Angelicaceæ or Umbelliferæ, Viteaceæ, Frankeniaceæ, Violaceæ, Cistaceæ, Tamaricaceæ, Linaceæ, Droseraceæ, Sarraceniaceæ, Tropæolaceæ, Oxalidaceæ, Geraniaceæ, Berberaceæ, Magnoliaceæ, Dilleniaceæ, Nymphæaceæ, Fumariaceæ, Brassicaceæ or Cruciferæ, Resedaceæ, Tremandraceæ, Aurantiaceæ, Rutidæ, and Hippocastanidæ. Of the SYRINGALES. Rubiaceæ, Valerianaceæ, Dipsaceæ, Calycereæ, and Cynaraceæ of the Compositæ, with part of Mutisiaceæ and Cichoraceæ; Stylidiaceæ, Goodeniaceæ, Epacridaceæ, Menthaceæ, Scrophulariaceæ, Verbascidæ, Polemoniaceæ, Boraginidæ, Hydrophyllidæ, Menyanthidæ, Fraxinidæ, and Globulariaceæ.

(4876.) Notwithstanding the *latitudinarianism* (if I may be allowed the expression,) that pervades the foregoing averages, there are a few groups which are so widely diffused, and so generally present in all the zones, as to afford no grounds for assuming their prevalence in either; these are the Hippuridaceæ,

Urticidæ, Polygonaceæ, Hypericaceæ, Elatinaceæ, Balsaminaceæ, Pittosporidæ, Rutaceæ, Ericidæ, Utriculariaceæ, Hydroleaceæ, Gentianidæ, Plantaginaceæ, and Armericaceæ, to which might be added, the Droseraceæ, the Asterinæ (collectively considered), and several other groups already enumerated, whose predominance is not very great in the several zones to which they have been referred, and to which they often appertain rather by geographical latitude than by climatorial right. But any averages of a more minute description belong rather to the special statistics of the vegetation of particular regions, than to the general outline here proposed to be given, and would, not only, here be out of place, but, if introduced, might extend these observations to an inconvenient length.

(4877.) Two further generalizations cannot however with propriety be omitted. In the first place, it is remarkable that those genera or species which are common to the torrid and temperate, to the temperate and frigid, or to all the several zones, are found of a larger size, and often assume an arborescent port, in the warmer regions; while in the extratropical and circumpolar latitudes they are reduced in size, often degenerating into shrubs or herbs. Thus the Araliaceæ are arborescent plants, the common Umbelliferæ herbaceous ones. The equatorial Asteraceæ trees or shrubs, those of the temperate zones undershrubs or herbs, and those of the circumpolar regions altogether lowly herbaceous plants. And, secondly, it is no less worthy of remark that the tropical genera include for the most part a greater number of species than those belonging to the extratropical zones; that the polar and circumpolar regions exhibit examples of a greater number of genera in any given number of species, *i. e.* possess fewer species of the genera present in them than either the torrid or the temperate zones, and that it is in the moister parts of the equinoctial, or the temperate regions, and especially in their warmer or subtropical latitudes, that individual plants are the most abundantly produced, and grow to the most excessive size.

GEOLOGICAL DISTRIBUTION OF THE ROSARES.

(4878.) From the vast predominance of this class over either, or all the others, having led to the belief of the Rosares being the especial plants of the present epoch, it might not unreasonably be presumed that in other eras, either antecedent, or succeeding to our own, they have been, or will be, found holding a less relative proportion to the other series. Do geological researches into the floras of the several periods of foregone ages corroborate this hypothesis, or must its confirmation be delayed until the strata now forming, and others hereafter to be formed, shall yield their fossil remains to future geologists, as those of long past ages are sought for and contemplated by us? An answer to this question may even now be readily given, as far as the examination of fossil remains affords means for its solution. In the earlier depositions, vestiges of Angiospermous dicotyledons or Rosares are few, and though not altogether absent even from the coal strata, as they were once supposed to be, still they are found in comparatively small proproportions to ferns, palms, and pines; and they only approximate their existing ratio in the strata deposited in epochs immediately antecedent to our own.

(4879.) This will be rendered evident even by a glance at the catalogues already framed, imperfect and insufficient as they confessedly are; for the remains of the walnut, willow, birch, elm, chesnut, and other recent genera, are not found lower than the tertiary or supercretaceous beds, many occur in diluvial, and more

in the alluvial deposits: a further fact of vast importance is, that the majority of the fossil remains associable with the Rosares are the remains of recent genera, very few relics of extinct species being found. And, as will be anticipated from the results of similar investigations into the relative distribution and affinities of fossils belonging to the other classes, those remains which are similar to plants at present in existence, are found in the superior or later formations, while those which, although exhibiting a relationship to recent vegetables, are specifically or generically different from any now known to be in existence, are met with in the lower or under strata.

(4880.) Of the vegetable exuviæ found in the soil, and among the detritus forming beds in the present day, nothing need be said. They, of course, are the remains of existing species, and are met with in a more or less decayed, or in a more or less preserved, condition, according to the character of the deposits in which they lie, whether in sand-banks, morasses, peat-bogs, &c. But the submarine forests, which are so continually cropping out on the sea-coasts, are most peculiarly interesting. They consist of multitudes of fragments, chiefly of dicotyledonous trees, many of which are recognizable, such as oak, elm, birch, poplar, willow, hazel, &c.; and the leaves as well as fruit of several are also found along with their woody trunks and branches, such especially as vast quantities of nuts.

One of these submarine forests, on the coast of Lincolnshire, has been well described by Correa de Serra. He says it was "composed of the roots, trunks, branches, and leaves of trees and shrubs, intermixed with aquatic plants, many of the roots still standing in the position in which they grew, while the trunks were laid prostrate. Birch, fir, and oak, were distinguishable, while other trees could not be determined. In general, the wood was decayed and compressed, but sound pieces were occasionally met with, and employed for economical purposes by the people of the country. The subsoil is clay, above which were several inches of compressed leaves, and among them some considered to be those of the (common holly) *Ilex Aquifolium*." Many similar deposits have been found, not only on the sea-coast, but inland, such as in Hatfield-bog, in Yorkshire; and the Lincolnshire-moor, as Correa terms it, is considered to extend at least from Peterborough to Sutton, which places are sixty miles apart. De la Beche has collected records from various sources of a great number of such deposits which have been discovered in all parts of these islands, from the Orkneys and Hebrides to Cornwall, as well as in numerous other parts of Europe, as on the shores of the Baltic, the coasts of Normandy, and so forth. That on the Frith of Tay is described, by Dr. Fleming, to consist "of the remains of leaves, stems, and roots, of many common plants of the natural orders Equisetaceæ, Gramineæ, and Cyperaceæ, mixed with the roots, leaves, and branches of birch, hazel, and probably also alder. Hazel-nuts destitute of kernel are of constant occurrence." Of another submarine forest, at Largo Bay, Dr. F. says, "the peat is composed of land and fresh water plants, among which are the remains of birch, hazel, and alder trees; hazel-nuts are also seen, and the root of one tree, apparently an alder, was traced more than six feet from the trunk."

In Tiree, one of the Hebrides, a submarine forest has been described by the Rev. C. Smith, in which, "besides the remains of trees. which are obvious, there are other and smaller plants, and numerous seeds which at first looked quite fresh, but afterwards became darker on exposure to the air. These seeds are said to have the appearance of belonging to some leguminous plant; and Mr.

Drummond suggests that they may probably be those of *Genista Anglica.* Another such bed has been found in Mount's-bay, Cornwall; and Dr. Boase says it consists of a brown mass composed of the bark, twigs, and leaves of trees, which appear to be almost entirely hazel. In this there are numerous branches and trunks of trees. The greater part of this wood is hazel, mixed with alder, elm, and oak. About a foot below the surface of this bed the chief part of the mass is composed of leaves, amongst which hazel-nuts are very abundant. Similar and other remains have been found in other places, and in some, as De la Beche continues, "the *Arundo Phragmites* so abounds, that the peaty moss seems entirely composed of it. The lower layers contain *Ceratophyllum demersum. Potamogeton pusillum, Najas major, Nymphæa lutea, Scirpus palustris,* and *Hippuris vulgaris,* are also discovered with the *Arundo.* Seeds, especially of the *Menyanthes trifoliata,* are likewise frequent in the lower layers."

(4881.) The similitude of the vegetable exuviæ in these recent beds with species now existing, is an important fact; but a fact of still greater importance is, their identity with the plants now growing on the surface of the earth in the countries where they are found. For, if organic remains deposited in beds now forming, or which have been formed during the present epoch, be similar to those now growing on the surface, there can be no reason to doubt that the fossil remains discovered in the older strata were similar to those then growing on the surface during the period in which they were laid up. If in the peat-bogs and submarine forests of the superior beds the only remains to be met with are those of native plants, and none are discovered belonging to distant regions, and which must have been conveyed from the present torrid to the temperate, or the frigid zones, the probability is great, if the conclusion be not wholly unavoidable, that, in the inferior strata, the fossils met with are those of vegetables which were then proper to the surface of the globe, in the latitudes in which they occur.

(4882.) Numerous other examples might be given of vegetable remains occurring in similar situations, but this would be a work of supererogation; therefore, let it suffice to observe, that throughout the upper fresh-water formation the remains are without exception those belonging to plants of our present existing flora. In the lower beds of the tertiary series, although the relics of recent plants are those which are the most abundant, peculiarities gradually occur; first, as in the lower fresh-water formation, vestiges of tropical species, such as some Sterculiæ, Cecropiæ, and arborescent Malvaceæ, are found; and in the London clay tropical fruits, of perhaps extinct species, abound in a fossil state: *e. g.* in one confined locality, viz. the Isle of Sheppy, "Mr. Crowe, of Faversham, has made a collection of seed-vessels, amounting to no less than 700 different varieties, of which very few agree with any existing seed-vessels known to botanists." (*Ure.*) Thus, even during the passage downwards through the tertiary beds alone, a most decided difference is observed in the characters of the fossils. For, taking Britain as an example, in the upper deposits there are discoverable nothing but the remains of British plants; while in the lower the fossils are those of vegetables now peculiar to the tropics, or to much warmer climates, than prevail in these latitudes in the present day.

(4883.) Besides the oak, the elm, the hazel, the chesnut, the birch, the alder, the poplar, and the willow, which occur so frequently in all the supercretaceous beds that they can scarcely be said to be proper to any one, although certainly most prevalent in the upper, there have been discovered a few fossils that have a more

limited range; thus, one of the *Nymphæaceæ*, *Nymphæa Arethusæ*, or probably *Nuphar lutea*, is found in the upper fresh-water formation. One species of *Betula*, *B. Dryadum*; one of *Carpinus*, *C. macroptera*; one of *Comptonia*, *C. acutiloba*, are met with in the lignite of the tertiary beds. And another species of *Comptonia*, *C. Dryandræfolia*, is peculiar to the lower fresh-water formation. The three or four species of walnuts known in a fossil state are said by Brongniart to be Juglans Nux Taurensis, proper to the upper marine deposit; *J. ventricosa* and *J. lævigata* to the lignites of the tertiary beds; and *J. Salinarum* to the marine formation of Wieluzka. Besides these, one species of Laurus, the *Cinnamomum*, is said to have been recognized in the fresh-water deposits, at Aix, where there have likewise been found the leaves of some leguminous plants, the generic affinities of which cannot be traced, and to which the name *Phaseolites* has been given.

(4884.) In the true secondary or supermedial strata, that is, in all the beds above the carboniferous, and below the supercretaceous series, the remains of plants belonging to this class are very rare. In the chalk and in the Jura, the shelly and the magnesian limestone, none have been found; and a solitary species of walnut is alone mentioned as having been discovered in the upper bed of new red sandstone.

(4885.) A remarkable change, however, occurs in the carboniferous series, for

A, *a*. Stigmaria ficoides. B. Calamites nodosus. C. Asterophyllites foliosa. C, *a*. Ditto galioides. D. Cardiocarpon acutum. (*a*) Ditto natural size. E. Sigillaria pachyderma. (*a*) Fragment of one of the branching roots. (*b*) Part of the decorticated stem.

[*From Lindley and Hutton's Fossil Flora.*]

there among ferns and palms, and pines, among the earlier and richer vegetations of the world, the *Rosares*, or at least some representatives of them, are met with

in profusion; and, though the extent may be almost inconceivable to those who have not personally examined the beds, to all who have seen them, the incredible abundance in which they are found may be taken as evidence of their prevalence in the coal epoch: as their exceeding size is a proof of their luxuriant growth. These fossils, which are familiar to all who have ever examined, or who have even entered a coal-mine, are the *Cactites* and *Euphorbites* of Sternberg, Artis, and others. Adolphe Brongniart, who doubts their relationship to the modern *Cacti* and *Euphorbiæ*, has called them *Sigillariæ* and *Stigmariæ*. As these latter names do not implicate any questioned proposition, they are perhaps the preferable ones; and the more especially as, although, from recent researches and observations, the opinions of Sternberg and Artis are in part confirmed, viz. as to their being the remains of succulent exogenous or dicotyledonous vegetables, possessed of distinct bark, wood, and pitch, but in which the parenchyma was greatly developed; still their immediate affinity to either of our modern succulent groups, such as the *Mesembraceæ*, *Crassulaceæ*, *Stapeliaceæ*, *Euphorbiaceæ*, and *Nopalaceæ*, cannot be said to be definitively determined. That their relationship to the latter two is by far the strongest there is no doubt; yet, as neither leaves, flowers, nor fruit, have been hitherto discovered, it is better not to assume a closer connexion than subsequent experience may be enabled to confirm.

(4886.) Von Martius, who enjoyed excellent opportunities of observing the habits and varied forms of *Cacti* in their most luxuriant states of modern growth, in Brazil, and the other parts of tropical America, appears to be strongly impressed with the close similitude observable between these fossils and recent *Cacti*; and he even attempts to trace the resemblance of the different fossil remains to several existing species, as to *Cactus tetragonus*, *pentagonus*, *hexagonus*, &c. While his *Cactites tessellatus*, he thinks rather to belong to the subgenus *Opuntia* than to the genuine *Cacti*. Lindley and Hutton, however, seem to incline to the opinion of the nearer connexion of the *Stigmariæ* to the *Euphorbiaceæ*, than to the *Nopalaceæ*, or rather, to some intermediate type that is now extinct.

(4887.) Besides the above, there are many other vegetable remains which appear to approximate the exogenous series, but the affinities of which are at present not well made out. There are various unrecognized stems, leaves, flowers, and fruits, known under the collective names of *Exogenites*, *Phyllites* (?) *Antholites* (?) and *Carpolithes*; some of which are indeed very questionable associates. These groups, which at present are for the most part heterogeneous and ill assorted, will hereafter be subdivided, so as to form more definite and satisfactory genera. Several generic groups have indeed already been separated from them, such as the *Annulariæ*, of which Brongniart mentions seven species as occurring in the coal measures, and some of these he thinks may belong to the genus *Bechera*; another species of which, *B. grandis*, he calls *Asterophyllites dubia*. Of the fossils named *Asterophyllites* 12 or 13 species have been distinguished; the whole of which, with a solitary exception, belong to the coal measures. This exception is however an important one, for *A. pygmea* is proper to the transition series. The affinities of the *Asterophyllites*, [§ 4885, c.] is very problematical. Brongniart suggests their resemblance to *Hippuris*, *Myriophyllum*, or *Ceratophyllum*, while the authors of the Fossil Flora of Great Britain hint at their similitude to some of the *Rubiaceæ*.

(4888.) The affinities of the so-called *Phyllotheca*, *Calamites*, [§ 4738, B], and

Volkmanniæ, have yet to be traced; further than that they have an exogenous tendency, and this less decided in the latter two than in the former, nothing can with safety be affirmed. The seeds, which have received the name of *Cardiocarpa,* are equally debateable as to their affinities; they are most probably the seeds of some dicotyledonous plant with an aggregate inflorescence, but whether they are the seeds of an *Asterophyllites,* or of some extinct genus of the *Umbelliferæ,* as suggested by Lindley and Hutton, it is impossible at present to determine.

(4889.) There is a very remarkable fossil, which Sternberg has included among his *Lepidodendra,* and called *L. dichotomum,* the *L. Sternbergii* of Brongniart; but Von Martius believes it to be the type of a new and distinct genus, which he proposes to name *Lychnophorites,* on account of its resemblance to the genus *Lychnophora,* which he discovered in the province of Minas Geraes, in Brazil, at the height of 2000 feet and upwards above the level of the sea, and especially in the diamond district. Of this newly discovered genus, which belongs to the natural order *Asterianæ* or *Compositæ,* there are several species, such as *Lychnophora Pinaster, rosmarinifolia,* &c., forming shrubs about the height of a man. "They are much allied," he continues, "to the *Vernoniæ* of Linneus, and the *Pullalestæ* of Humboldt, which seem to correspond in every particular with our petrified plant." And hence, if the conclusion of Martius be correct, there is found in the coal-seams of the North of England the relics of a plant allied to the tropical arborescent compositæ of the present day.

(4890.) Thus it appears that the correspondence of the geographical distribution with the geological position of the *Rosares* is, like that of the other classes, most decided. These plants, which are now so prevalent on the surface of the earth as to constitute emphatically *the* Flora of our epoch, are found in profusion in the upper strata of the globe: there, and there only, do they obtain any thing like the proportion to other fossils that they hold with relation to other recent plants. From the secondary strata they are all but absent; and, although they are found in profusion in the carboniferous rocks, they are only present by the relics of genera now extinct, and the nearest resemblances of which are our tropical *Euphorbiaceæ* and *Nopalaceæ,* or to the arborescent *Compositæ,* peculiar now to equinoctial regions, and especially to insular situations within the torrid zone. The extraordinary similitude, nay, almost absolute identity, of the organic remains of the superficial strata in European countries with their existing flora, is most worthy of remark; and, although the geological researches in other quarters of the globe do not as yet afford the means of ascertaining whether such a parallel exists every where, still, as in the alluvial deposits, and in the upper tertiary beds of northern latitudes, plants proper to the northern regions are found; so likewise it is more than probable, that when examinations are made, the remains of recent tropical plants will be found in the equivalent beds of the torrid zone. But what will be the probable character of the fossil remains of the equinoctial coal-beds? what plants will they resemble? and how great will their deviation be from any existing species?—seeing that the fossils of our carboniferous series appear to be the remains of vegetables, which enjoyed a climate hotter than that which now prevails beneath the line.

OUTLINES OF SELANTHOLOGIA.

(4891.) Certain splendid Oriental parasites, only within the last few years discovered, and several others, natives both of Europe and America, which, although longer found, can scarcely be said to have been longer truly known, so strangely were they at one time misunderstood, form, like the Cycases and the Pines, a small but very natural class, and one in which, by a rapid series of degradations, the most highly developed plants, the most elaborate examples of vegetable structure, are affianced, and become connected with some of the earliest and simplest grades.

(4892.) The gorgeous appearance and gigantic size of some of these extraordinary parasites, such as the *Rafflesiæ*, may well vindicate their collective appellation, SELANTHI, should that word seem preferable to CYTINARES, a derivative of *Cytinus*, the name of one of the longest known, but more humble and less showy genera. To these terms, however, as the whole of the plants are foreigners, and the chief of extra-European growth, no familiar English equivalents can be expected to be found; and hence *Selworts*, formed on the model of some of the older names of plants, such as *Sel*-ago, ground-*sel*, &c. may be taken as a translation or a synonyme.

(4893.) The *Selanthi* are cellular or almost evascular leafless flowering plants; thus, in their organs of vegetation being connected with the leafless, flowerless fungi, and by their organs of fructification with the tubivascular mono- and di-cotyledons; and hence has arisen the systematic paradoxes of at one time beholding these so-called cellular plants arranged amongst the tubivascular *Exogenæ* and *Endogenæ*, and at another of finding some of them,

as the *Rafflesiæ*, which consist exclusively of flower, located amongst the flowerless acotyledons in the class *Cryptogamia.*

Several anticipations of a relapse towards the earliest and simplest forms of vegetable structure were observable in the preceding class; for some of the parasitic *Rosares*, such especially as the *Orobanchaceæ*, *Monotropa* of the *Pyrolidæ*, and even *Cuscuta* of the *Convolvulaceæ*, agree in their parasitic habit with these plants; and the former are not only destitute of leaves, but also are furnished with scales in their stead, while the latter not only has an acotyledonous embryo, but establishes, through its associates, the *Convolvulidæ*, where the seed-lobes are shrivelled, a connexion between the embryonate and inembryonate vegetables: indeed, it is a question still undecided, whether *Lathræa* does or does not produce perfect seeds.

(4894.) CYTINUS, the *Hypocist* of the ancients, and CYNOMORIUM [§ 114], the old *Fungus Melitensis*, or mushroom of Malta, have been the longest known, and at various times, as already hinted, they have been very variously placed in systematic arrangements. The latter, as its old name, *Maltese Champignon*, hints, was at one time supposed to be a *fungus*: by Jussieu it was left unarranged; but by Richard it was subsequently associated with *Cytinus*, and placed amongst the dicotyledonous *Exogenæ*: by others, however, both it and several of its West Indian allies have been affirmed to be mono- rather than dicotyledonous plants, and their nearest affinities declared to be with the *Aroideæ* (Callaceæ) and *Hydrocharideæ*. Agardh, on the contrary, includes them among the *Urticidæ*, considering them indeed only a subdivision of his *Urticeæ*; while Brown, who associates *Rafflesia* with *Cytinus*, and sanctions Brongniart's opinion of its relationship with *Nepenthes*, also corroborates Jussieu's approximation of *Cytinus* to the *Asarinæ*, or *Aristolochiaceæ*; but he considers the other genera as essentially distinct. Blume, in his *Flora Javæ*, has given to *Cytinus*, the *Rafflesiæ*, and their immediate allies, the common name *Rhizantheæ*; and Sprengel makes the *Rhizantheæ*, some of which consist of flower alone, the first order of his *Cryptogamia*, or flowerless class. Bartling associates the whole with the peppers, the taccas, and the water-lilies, under the collective term *Chlamydoblasta*, a subdivision of his *Vegetabilia dicotyledonea*; and numerous other speculations as to their systematic disposition have been adventured, one of the most plausible of which is their association with the parasitic *Orobanches*; but these it would be tedious further to dwell on, as the foregoing examples will sufficiently prove the uncertainty as to their chief affinities which has so long prevailed, and may excuse, if not justify, the present scheme.

(4895.) As already stated in the general Outline [§ 109, 110, 113], these vegetables differ from other flowering plants, whether of the *Exogenous* or *Endogenous* series, not only by their habit and port, both of which are peculiar, but also in their internal structure; for anatomical investigations have shown that, like the *fungi*, which they so curiously simulate in their destitution of leaves and parasitic habits, they chiefly consist of cellular or subcellular structure, which is

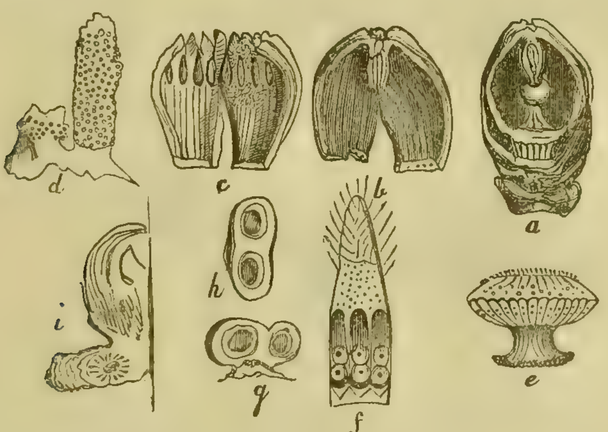
a further resemblance of great importance. It has indeed been affirmed, and generally believed, that they are altogether destitute of tubular vessels, whether

Brugmansia Zippeli.

(*a*) A fully developed plant, growing parasitically on the root of a cissus, with two others, in a very young state.

(*b c*) Other plants, in further stages of growth, to shew the scales by which the flower is enclosed, as by an hybernacle.

spiral or simple. Blume, who had admirable opportunities of pursuing anatomical investigations in the countries where the *Rafflesiaceæ* are indigenous, figures them as wholly cellular, and expressly states that they are destitute of tubular vessels; the only ones found in or about them being, according to him,



Anatomy of the *Brugmansia Zippeli.*

(*i*) Section through a plant while in the state of a bud, shewing its enveloping scales, and attachment to the roots of the cissus. (*a*) Longitudinal section through a plant previous to the opening of the flower. (*b c*) Internal views of the perianth. (*e*) The central column, to which the anthers are attached. (*f*) Portion of the column, with several anthers attached. (*g*) Transverse section of an anther. (*h*) Longitudinal ditto. (*d*) Section of the walls of the fruit, or pseudocarp, with the seeds (*spores*) attached.

those of the cissi, on the roots of which they grow, and which sometimes are confounded with the bases of the parasites. This doctrine was also held by Brown, who, when he published his admirable monograph on *Rafflesia Arnoldi*, maintained their cellular structure. This opinion of their utter destitution of

tubular vessels he has, however, since found reason to modify; for, as might almost have been anticipated, from the subfoliaceous appearance and strong ribs of the bud-scales of the *Rafflesia*, he has detected tubular vessels in them, both spiral and others, but they are very few in number, and not only spare, but also oftentimes imperfect. This is an important discovery, as it renders the transition from the Rosares, and the other tubivascular flowering plants, less sudden and abrupt than if they had been wholly evascular. Their fruit likewise he describes as being not quite so simple as had been previously supposed; for, although the seeds consist of a soft and nearly homogeneous mass, albumen and embryo are distinguishable, and hence, although spore-like, they are not veritable spores.

(4896.) These late observations of Dr. Brown were communicated to the Linnean Society while these pages have been passing through the press; and

Anatomy of the *Brugmansia Zippeli.* (Blume.)

(*d*) Transverse section of the root of the cissus, on which the plants grow parasitically, with a view of the confused substance at the base of the *Brugmansia*. (*a*) Section of the intermediate body, formed between the parasite and the cissus, which consists of cellular structure, permeated by tubular vessels. (*b*) Base of the parasite, and upper portion of the intermediate body, destitute of tubular vessels. (*c*) Longitudinal section of an anther, shewing the cellular structure of its parietes, and the locule containing a little pollen. (*e*) One of the cellular ovules (or spores), with its pedicel. (*l*) Section of the walls of the fruit (pseudocarp), shewing the attachment of 2 ovules. (*g h*) The mass of cellular substance of which the spore consists.

although, from the essay being as yet unpublished, advantage may not be taken of the whole of its contents, it would have been unjustifiable not to have introduced his correction of the generally received opinion of the utter evascular condition of

these plants. And this, the more especially as it so unexpectedly and in so decided a manner corroborates the present scheme of classification, rendering the Selanthi no longer anomalies in the tubivascular region, and confirming the view which has been taken of their intermediate rank between the Rosares and the Fungi.

(4897.) Collectively described, the SELANTHI or *Cytinares* are parasitic herbaceous plants, consisting wholly or chiefly of cellular structure, and destitute or nearly so of tubular vessels. The axis is sometimes abortive, sometimes developed as a horizontal branched rhizoma, and sometimes as a simple or divided stem. The leaves are absent, the foliage consisting of brown or colourless scales, more or less foliaceous in their appearance; part enclosing the buds, and part rendering the stem squamose.

The inflorescence is solitary or aggregate, usually spadiceous, and the flowers for the most part separate, rarely united.

The perianth is single, the stamens definite, more or less cohering both by stamens and anthers. The germen is inferior, invested by the adherent tube of the calyx, 1- or many-celled, and 1- or many-ovuled.

The fruit is dry or pulpy, a caryopsis or a berry, and indehiscent. The seeds are albuminous, the albumen fleshy, the embryo very minute, divided or undivided, (*i. e.* mono- or dicotyledonous ?) but sometimes not readily distinguishable from the albumen, the whole nucleus often consisting of a mass of homogeneous grumous matter.

(4898.) Hence, differentially considered, the *Selanthi* or *Cytinares* are cellular or subcellular flowering parasites, with spore-like seeds, and furnished with scales instead of leaves.

(4829.) As these plants, in themselves said to be acotyledonous, have been, and still are to the present day, referred by the most accomplished naturalists in part to the monocotyledonous, and in part to the dicotyledonous series, the differences in structure and appearance which have led to such distinctions might reasonably be expected to indicate at least two very different orders, notwithstanding their association in the same class. Two chief subdivisions are indeed recognizable, but there is so much similitude in their diversities, that it is somewhat questionable whether they should be considered as distinct orders, or merely as types or sections of one and the same. The differences, however, do on the whole seem to be sufficient to constitute them separate orders.

(4900.) *Cytinus* and *Cynomorium*, the two longest known and most familiar genera, give their names respectively to these two orders, which are all that this class includes; hence the one is called *Cytinales*, and the other *Cynomoriales*.

(4901.) The *Cytinales* are (dicotyledonous ?) *Selanthi*, with a 1- or many-celled ovary, parietal placentæ, many ovules, and the divided embryo straight, axile, and included within the albumen.

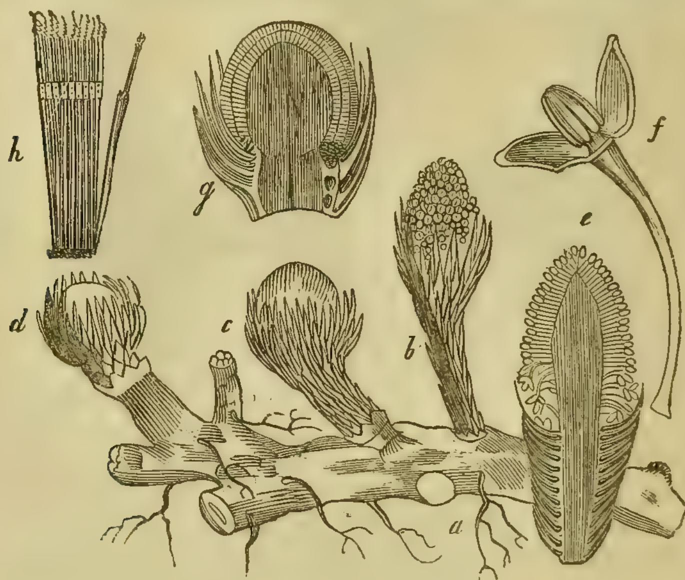
(4902.) The *Cynomoriales* are (monocotyledonous ?) *Selanthi*, with a 1-celled ovary, a solitary pendulous ovule, the embryo undivided, globose, and lodged in a superficial excavation of the albumen.

CYNOMORIALES.

(4903.) *Cynomorium*, *Langsdorfia*, *Helosis*, and *Balanophora*, the presumed monocotyledonous *Cytinares* which form this order, are distributable into two

subordinate groups, which, from the first and last named genera, have been called the *Cynomoriaceæ* and *Balonophoraceæ:* but as these types differ in very few and slight particulars, one general description will suffice, their particular differential characters being subsequently separately given.

(4904.) Collectively described, the *Cynomoriales* are herbaceous fungoid plants, growing parasitically on the roots of shrubs or trees, and having a simple, roundish stem, erect and simple, or horizontal and branched, and either scaly or naked. The inflorescence is terminal and congested in spadiceous heads, and the flowers monœcious or diœcious, rarely united. The receptacle is fleshy, variable in form, usually covered with squamæ or setæ, rarely naked, and also occasionally bearing thick peltate scales, by which the mass of inflorescence is invested. The stamineous flowers are pedicellate, the perianth simple, equal, with a tripartite patent limb, the segments of which are slightly concave, rarely reduced to a single



Langsdorfia Janeirensis. (*a*) The subterranean stem or rhizoma, with rootlets that attach themselves to neighbouring plants. (*b, c, d*) Branches without leaves, but covered with scales, and bearing the heads of flowers. (*e*) A mass of inflorescence cut through lengthwise, to exhibit the receptacle, stamineous flowers, scales, &c. (*f*) A stamineous flower separated, and one division of the calyx removed to shew the anther. (*g*) A longitudinal section through a mass of pistilline flowers, to shew the receptacle demonstrate, scales, &c. (*h*) Several pistilline flowers, removed to shew the long pedicels of the verrucate calyx, the filiform styles and subclavate stigmata often beset with tubercles or glands. The fruit of this plant is as yet unknown.

scale, as in *Cynomorium.* The stamens are epigynous, 3 (very seldom more) and rarely 1, as in *Cynomorium.* The filaments monadelphous, and the anthers connate. In the pistilline flowers the germen is adnate to the tube of the calyx, the epigynous limb abbreviated, entire or 2-4 parted, and unequal. The inferior ovary is 1-celled and uniovulate, and the ovule pendulous. The styles 2 or 1, and filiform, and the stigmata simple, terminal, and rather convex. The fruit is

globose, hard, and akeniaceous, crowned with the persistent limb of the calyx, which is either marginal and nearly reversed, or consists of 2-4 unequal segments. The seed is solitary and inverted. The albumen large and fleshy. The embryo very small, globose, undivided (monocotyledonous), and situated in a superficial cavity of the albumen.

(4905.) The two types are distinguished by the following peculiarities of structure.

(4906.) In the *Cynomoriaceæ* the perianth is reduced to a single sepal; and the stamen being solitary is necessarily discrete, *i. e.* can be neither syngenesious nor monadelphous;

(4907.) While in the *Balanophoraceæ* the perianth is trisepalous in the stamineous flowers, although abridged and abortive in the pistilline ones, and the stamens are several and connate.

(4908.) Of the uses and properties of these plants there is very little known. The *Cynomorium coccineum* [vide fig. § 114], already mentioned, has been used

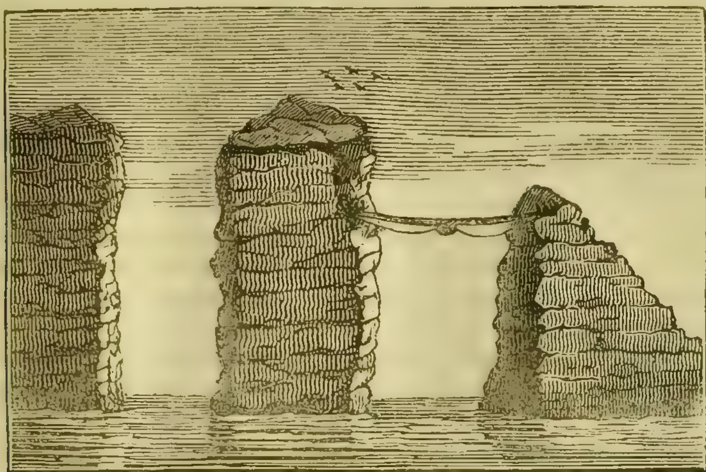
Helosis Guayanensis. (*a, b, c, d, e, f*) Plants in different stages of growth and development, from the bud to maturity, shewing their leafless stems and inflorescence. (*g*) Flowers separated from the capitulum. (*h*) Flowers, stamineous and pistilline, among the paleæ of the receptacle. (*i*) A pistilline flower separate. (*j*) One of the scales by which the flowers are covered before development. (*k*) One of the hair-like processes of the receptacle. (*l*) The receptacle when all the flowers have been removed. (*m*) The fruit. (*n*) A longitudinal section.

as an astringent, and it once enjoyed a very high reputation as a styptic; but its influence in arresting hæmorrhages seems to have lessened with the diminution of the faith, or rather superstition, which probably was at all times more efficacious than the drug. This Maltese mushroom, however, does yield on pressure a red bitter astringent juice, which, were other styptics absent, might be allowed to sup-

ply their place; and, before the invention of the tourniquet, the powdered plant is said to have been in frequent use in surgical operations, and constantly applied to the stumps of amputated limbs, as it still is to recent wounds, in order to restrain the bleeding. Dr. Muscat, a Maltese physician, states it as his opinion, formed after an extensive practice of many years, that the *Cynomorium* possesses a peculiar influence over the uterus, and that both in powder and tincture he has found it most serviceable in menorrhagia, and other uterine disorders. An interesting account of the habits and uses of this plant was sent by Dr. Walsh to the Medico-Botanical Society, and from his essay the above and the following are extracts.

Dr. Walsh says, "this fungus grows most plentifully on a detached rock on the south-west side of the island of Goza. It is there much celebrated for its medicinal properties; the time of the discovery of its virtues is not known, but, from some ancient MSS., it appears to have been at a very remote period. It had been the usage of Malta to banish to Goza all females of a dishonest character; and here, according to tradition, they found a vegetable substance of an astringent quality, which proved very efficacious in removing the consequences of their irregular life. It was prepared in earthen pots, some of which have since been dug up in various places, marked with Phœnician characters, indicating their use. The plant was also applied by them to the purposes of divination. It was laid between the breasts, and, from some accidental circumstances of position, &c. they augured good or bad fortune. This practice was reproved, and said to have been finally abolished, by a Capuchin missionary. This curious vegetable was subsequently esteemed as a remedy in dysentery, and its curative powers were long held in very high repute. About the year 1740, the knights of Malta set such a high value on the fungus, that they interdicted the approach of any person towards the place where it grew, and guarded the passage with the strictest jealousy. In April, when the fungus was ripe, it was carefully gathered by persons appointed for that especial duty, and the precious morsels were deposited in a government-office, from whence some portions were sent as presents by the grand master of different sovereigns, and the remainder distributed among the hospitals of the island. Even after the English took possession of Malta, and succeeded to the territorial rights of the order, and, amongst other things, to the possession of this rock, a *custode* was appointed to take care of it, as heretofore, with a salary, which always makes an item in the public accounts of Malta. The fungus is thus continued to be guarded and regularly gathered, deposited in the state-office, and distributed among the hospitals; and, when Dr. Hamilton, through the kindness of an official person in Goza, was permitted to visit this rock, he was accompanied by the custode. The rock, as shewn by the doctor's sketch, is difficult of approach: it is an isolated precipice, about 600 feet in height, detached from the neighbouring shore, and presenting very steep and inaccessible sides, in some places projecting considerably over the sea, so that the circumference of the base is less than that of the upper parts. It stands on the verge of a noble circular basin, formed by the surrounding cliffs, into which the sea enters by the chasms at each side of the fungus rock, the whole presenting the aspect of the crater of a volcano, raised from beneath, or extinguished by an irruption of the sea. This columnar rock, on which (if the frail sisterhood said to have been banished ever reached its summit,) they might have emulated the penance of St. Simon Stylites, is rendered accessible by cables fixed from the nearest promontory across the

chasm to a projection about two-thirds up the precipice, and on them is slung a box capable of containing one person, and which, being furnished with pulleys



Elevation of the *Hagira tal Gernal* or Fungus Rock, near the island of Goza, as it appears from the interior of the basin.

and a leading rope, can be pulled backwards and forwards as required: but it did seem to me, adds Dr. Walsh, "when I arrived at the summit of the rock, to be a very fragile conveyance in which to be launched across a gulf 300 feet in width, at what appeared to be about the height of Dover cliffs, with the sea boiling beneath;" a voyage certainly not to be compensated by the acquisition of the fungus.

CYTINALES.

(4909.) *Cytinus, Apodanthes,* and *Sarcophytum* or *Ichthyosma,* with *Aphyteia, Gonyanthes, Rafflesia,* and Blume's new genus *Brugmansia,* which are included in this order, are distinguishable into two types or sections, which it is proposed to call *Cytinaceæ* and *Rafflesiaceæ;* but as these divisions are not generally acknowledged, it will be better, as in the preceding order, to let their general description precede their differential characters.

(4910.) The Cytinales (or *Cytineæ*) are cellular or subcellular herbaceous plants, growing parasitically on the roots of trees or shrubs, with often an abortive axis, sometimes a simple or irregularly divided stem, which is fleshy, round or sulcate, and either scaly or nearly naked. The inflorescence is terminal, solitary, or aggregate, and the flowers monœcious or diœcious, rarely united.

In the stamineous flowers, the perianth, which is single, is 4-5- or more, rarely 3-cleft, and the lobes imbricate or induplicate in æstivation. The stamens in general numerous, rarely so few as the segments of the calyx, and then opposite to them. The filaments are connate, forming a central column, and the anthers adnate; either dehiscent lengthwise and extrorsely, or discharging their pollen by orifices at the apex. In the pistilline flowers the perianth is adnate to the germen, its limb epigynous and cleft, as in the stamineous flowers. The ovary is formed of several connate carpels, 1- or many-celled, the placentæ 4-8 or more, parietal, and many-ovuled. The styles, which equal the trophosperms in number, form a cylindrical column, sometimes much shortened and connate, and the stigmata are nearly free and patent.

The fruit (Pseudocarp of Blume, Peridium, Sporangium of Link,) is inferior and baccate, indehiscent, 1-celled, with several or many parietal placentæ, the seeds (spores of Blume) numerous and very minute, with a dense covering on a cellular grumous nucleus. The albumen when distinguishable fleshy, the embryo straight, axile, included, and cleft (or dicotyledonous).

(4911.) The two included types differ in several more or less important particulars, and these differences in structure constitute their diagnostic characters.

(4912.) The *Rafflesiaceæ* are fleshy, globose, fungus-like parasites, destitute of roots, with an abortive axis, and germinate beneath the bark or cortical integuments of other plants; they are acaulescent, aphyllous, and squamous, with solitary flowers enveloped by the scales, the flowers united, or diœcious by abortion, the sepals many, and imbricate or induplicate in æstivation, and the anthers dehiscent by terminal pores;

(4913.) While the *Cytinaceæ* are more or less caulescent, the sepals few, 4 or 5, and imbricate in æstivation, the stamens few, and the anthers dehiscent lengthwise by chinks.

(4914.) Hence, differentially considered, the *Rafflesiaceæ* are globose *Cytinales,* with many sepals, and anthers dehiscent by terminal pores;

(4915.) While the *Cytinaceæ* are subcaulescent *Cytinales,* with few sepals (4-5), and anthers dehiscent lengthwise by extrorse chinks.

(4916.) Cytineaceæ. *Cytinus Hypocistus* has long been celebrated as a tonic and astringent. Its taste is slightly acid, but neither bitter nor austere. It is

A *Cytinus Hypocistus.* Two plants growing parasitically.

(*a*) A sterile or stamineous flower.

(*b*) A vertical section of the same.

(*c*) Section of a flower-bud (plan), to shew the mode of æstivation.

(*d*) Fertile or pistilliferous flower.

(*e*) Vertical section of the same, to shew the 1-celled germen and multiovulate parietal placentæ.

(*f*, *g*) Different sections of the stigma, the first longitudinal, the other transverse.

(*h*) An ovule separated from the placenta, and magnified.

said not to contain any tannin, but yet it precipitates gelatine from its solutions. That gallic acid is present, would appear from its forming a very black ink with solutions of the proto-salts of iron. On the continent a medicinal extract is prepared from the plant, which is called *Hypociste.* It is sold in small lozenge-

like pieces that melt away in the mouth, and these troches are esteemed by many persons as stomachics and corroborants.

(4917.) Rafflesiaceæ. The plants associated to form this group are as yet but partially and imperfectly known. They are all more or less astringent: the *Rafflesia Arnoldi* is said to be a most powerful styptic. In Java it is used medicinally to arrest morbid discharges, and its effects are said to be very decided; but the physiological interest of these plants far exceeds their direct economical or medicinal value; and the stupendous *Rafflesia Arnoldi*, or *Krúbút*, has not inappropriately been called the "Vegetable Titan." [See fig. § 111.] This gigantic flower, well named *Ambun Ambun, wonder-wonder*, or flower of flowers, by the natives, was discovered in the year 1818, when Sir Stamford Raffles, then Governor of Sumatra, made his first excursion from Bencoolen into the interior of the island. In that journey he was accompanied by a naturalist of great zeal and acquirements, the late Dr. Joseph Arnold, a member of the Linnean Society, from whose researches, aided by the friendship and influence of the governor, in a field so favorably situated and so imperfectly traversed as Sumatra, the greatest expectations had been formed. But these expectations were never to be realized; for the same letter which gave us the first account of the gigantic flower brought also the intelligence of Dr. Arnold's death. This letter was one from Sir Stamford Raffles to Sir Joseph Banks; and in it was enclosed the following extract, in the handwriting of the lamented Arnold, which formed part of an epistle (left unfinished) to some unknown friend, in which he gives a lively account of the discovery of this, which Sir Stamford Raffles well denominated "most magnificent flower." After describing the previous route, Arnold thus continues:

"At Pulo-Lebbar, on the Manna River, two days' journey inland of Manna, I rejoice to tell you I happened to meet with what I consider the greatest prodigy of the vegetable world. I had ventured some way before the party, when one of the Malay servants came running to me, with wonder in his eyes, and said, 'Come with me, sir, come and see a flower, very large—beautiful—wonderful!' I immediately went with the man about a hundred yards into the jungle, and he pointed to a flower growing close to the ground under the bushes, which was truly astonishing. My first impulse was to cut it up, and carry it to the hut. I therefore seized the Malay's parang (a sort of instrument like a woodman's chopping-hook), and finding that it sprang from a small root which ran horizontally (about as large as two fingers, or a little more), I soon detached it, and removed it to our hut. To tell you the truth, had I been alone, and had there been no witnesses, I should, I think, have been fearful of mentioning the dimensions of this flower, so much does it exceed every flower I have ever seen or heard of; but I had Sir Stamford and Lady Raffles with me, and a Mr. Palsgrave, a respectable man, resident at Manna, who, though equally astonished with myself, yet are able to testify as to the truth.

"The whole flower was of a very thick substance, the petals and nectary being in but few places less than a quarter of an inch thick, and in some places three quarters of an inch; the substance of it was very succulent. When I first saw it, a swarm of flies were hovering over the mouth of the nectary, and apparently laying their eggs in the substance of it; it had precisely the smell of tainted beef.

"Now for the dimensions, which are the most astonishing part of the flower. It measured a *full yard across;* the petals, which were subrotund, being 12 inches

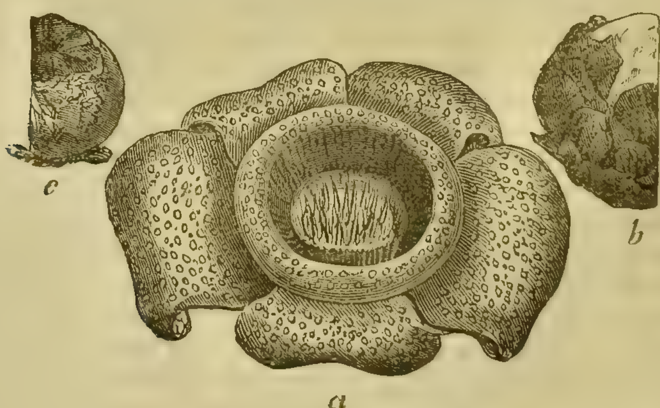
from the base to the apex, and it being a foot from the insertion of the one petal to the opposite one; Sir Stamford, Lady Raffles, and myself, taking immediate measures to be accurate in this respect, by pinning four large sheets of paper together, and cutting them the precise size of the flower. The *nectarium*, in the opinion of us all, *would hold twelve pints*, and the weight of this prodigy we calculated to be *fifteen pounds!*

"A guide from the interior of the country said that such flowers were rare, but that he had seen several, and that the natives call them *Krûbût*."

Later information has shewn that the *Krûbût*, or great flower, is much more generally known to the Sumatrese than its first European discoverers suspected; for in subsequent letters from Sir S. Raffles and Mr. Jack are the following passages:

"I find the *Krûbût*, or great flower, to be much more general and extensively known than I expected. In some districts it is simply called *Ambun Ambun*. It takes three months from the first appearance of the bud to the full complete expansion of the flower; and the flower appears but once a year, at the conclusion of the rainy season. It has no stem of its own, but is parasitic on the roots and stems of a ligneous species of cissus, with ternate and quinate leaves (*Cissus angustifolia*.) It appears to take its origin in some crack or hollow of the stem, and soon shews itself in the form of a round knob, which, when cut through, exhibits the infant flower, enveloped in numerous bracteal sheaths, which successively open and wither, until, at the time of its fulness of growth, but very few remain; the blossoms rot away not long after their expansion, and the seeds or spores are dispersed throughout the pulpy mass."

This giant flower may well indeed be esteemed the wonder of the vegetable world; and, although several others similar to it in form and habit have been



Rafflesia Patma.

(*a*) Entire flower. (*b*) Section of a bud beginning to expand.
(*c*) Another, before expansion.

found, none have as yet been discovered that equal Arnold's flower in size. A small species has been mentioned by Dr. Horsfield; but his flower, instead of measuring *three feet* across, only measured *three inches*. A second very magni-

ficent species, measuring two feet in diameter, has been discovered in a small island near Java, called *Nusa Kambangar;* and this has been figured by Blume in his Flora Javæ, from which the accompanying representation is a copy. By the natives it is called *Patma;* and hence the botanical name proposed for it is *Rafflesia Patma*. Another of these vegetable paradoxes, figured also by Blume, is a native of the province of Buitenzorg, in the western parts of Java, and grows at the height of from 1200 to 1500 feet above the level of the sea. He has called it *Brugmansia Zippeli;* the generic term is however untenable, as a genus separated from *Datura* [§ 4512] had previously been dedicated to Brugmans, and received his name.

(4918.) These fungoid flowers, which so curiously combine the most essentially diverse structures, close the descriptive part of these general Outlines; for, after having in the preceding classes traced the development and gradual perfecting of the vegetable organismus, and followed the several stages of evolution, from the cellular and seedless through the tubivascular and seed-bearing plants, a return is made, in the *Cytinales,* from the 2-lobed and 1-lobed *Exogenæ* and *Endogenæ,* even to the acotyledonous cellulares, viz. to that part of the series whence the earliest examples were taken, and with which the details were begun. For, although the *Rafflesiæ* consist of blossom only, yet in them the characters of a flower are almost extinct. The bud resembles a fungus, the pericarp becomes a peridium, and the seeds assume the condition of spores. Indeed, the parasitic habits and general appearance of these plants and their allies, *Cynomorium, Helosis,* and *Balanophora,* might well lead to their approximation to the fungi, and vindicate for the latter its specific name, *fungosa,* and for the former its old appellations of *Fungus Typhoides* vel *Melitensis,* the Maltese champignon, or mushroom of Malta.

(4919.) The subdivisions of this class are so few, that, excepting for the sake of obedience to the hitherto unbroken rule of concluding the details of each with a conspectus, it would scarcely be necessary to repeat them in a tabular form.

Class.	*Orders.*	*Sections or Types.*
Selanthi, or Cytinares (4897-8.)	Cynomoriales (4902-4.)	*Balanophoraceæ* (4907.) *Cynomoriaceæ* (4906.)
	Cytinales (4901-10.)	*Cytinaceæ* (4913-5.) *Rafflesiaceæ* (4912-4.)

GEOGRAPHICAL AND GEOLOGICAL CONSIDERATIONS.

(4920.) The Selanthi, or *Cytinares,* belong exclusively to warm countries; they are chiefly natives of the torrid zone in either hemisphere, sometimes, however, being found at considerable elevations, and occasionally, as in the case of *Cytinus* and *Cynomorium,* extending as far north as the southern parts of Europe. *Helosis* and *Langsdorfia* are natives of the West Indies, or Continental America within the tropics; *Aphyteia* of equinoctial Africa; *Balanophora* of the New Hebrides; and the *Rafflesiæ* have hitherto been only found in Java and Sumatra.

(4921.) Hence their distribution assumes rather a local than a general character, a special than a general interest. Like the *Fungi,* to which they bear

such strange similitude, the *Selanthi* are unknown in a fossil state. The coincidence is worthy of remark; for this negative fact, although it at once prevents any special geological disquisitions, is not without its value in more general researches into the present and former conditions of the vegetable world.

(4922.) Having concluded the separate histories of the nine natural classes into which plants have been divided, and appended to the descriptive details of each, their geographical distribution and geological positions, as far as either have been hitherto determined, it only now remains to give a general summary of the relative proportions in which they occur in the several great divisions of the world, *i.e.* of the vegetable statistics of the several zones.

(4923.) The five zones with which geographers encircle the globe, although very arbitrary divisions of its surface, and the parallels of latitude, although very often discordant with the isothermal lines which indicate the mean temperature or actual climate of different regions, are still, from their universal acceptation, the most convenient demarcations for general reference; and, notwithstanding their frequent deviations from the climatorial belts, they are yet sufficiently coincident for general statistical considerations, which are all with which we at present are concerned; the absolute numbers and the relative proportions in which the different tribes of plants spontaneously occur, or are cultivated by art in any particular region or country, forming a part of the natural history of that spot, or of the special vegetable statistics of that individual place.

(4924.) Of the 50,000 known species of existing vegetables, the cellular flowerless plants being estimated at 8 or 10,000, and the flowering or tubivascular ones at upwards of 40,000, of which the endogenous tribes may amount to 9 or 10,000, and the exogenous ones to more than 30,000, it would appear that between 20 and 25,000, *i. e.* about half of all known vegetables, are natives of the torrid zone. Of these it has been computed that upwards of 13,000 flowering plants are indigenous to equinoctial America, between 5 and 6,000 to equatorial Asia, and about 3,500 to Africa within the tropics, including both the continental countries and the dependent isles. In Australia and the islands of the Pacific about 5,000 species have been discovered, some of which belong to the torrid and some to the temperate zone. Besides these, nearly 2,000 belong to the temperate parts of Asia, above 4,000 to the temperate regions of America, both in the northern and southern hemispheres, and 7,000 to Europe, most of which are proper to its temperate latitudes, and very few to its polar regions. Of the antarctic vegetation there is next to nothing known.

(4925.) The *Cryptogamic*, or flowerless cellular plants, have been purposely left out of the previous calculations, for they are almost peculiar to the circumpolar regions and the colder parts of the temperate zones. The *Protococci*, which alternate in layers with the arctic snows; the Lichens, which cover the polar rocks; the Mosses, which flourish within the frigid zone, are all but absent from the intertropical regions; and the *Confervæ*, with which the icy waters of Lapland, and Sweden, and Scotland abound, and which, although plentiful in Britain, and the colder parts of the north temperate regions, yet gradually become more scarce in the southern ones, in the equatorial latitudes are almost unknown; the *Fuci* being the chief representatives of these tribes within the tropics: and even *Fungi*,

the most vagrant of all vegetables, and which in high latitudes are so extraordinarily abundant, so numerous in their species, and so profuse in individual production, are rare in lower ones, and from countries near the equator they are almost or altogether absent.

(4926.) In the stead, however, of Confervæ, lichens, and mosses, equinoctial vegetation consists of palms and arboreous ferns, of arborescent grasses and tree-like *Musaceæ;* the dense and interminable forests are formed of gigantic ever-green trees, to which belong the myrtle, the nutmeg, the clove, the turpentine, and the coffee tribes: instead of woodbines; there are peppers and passion-flowers: instead of sedges; ginger, cardamom, zedoary: and, instead of parasitic fungi, epiphytic *Orchidinæ.* The *Malvaceæ*, the *Euphorbiaceæ*, the *Urticaceæ*, and even the *Composita* and *Gramina*, become arborescent; so that within the torrid zone there are few rich pasture lands, thick and almost impenetrable jungles displacing our rich boundless meadows and daisy-spangled meads.

(4927.) In the temperate zones, as the distance gradually increases from the equator, the forest-trees become deciduous; the olive and the grape are less and less common, until at length oil and wine are superseded, as common articles of human food, by beer and butter; the bamboos and rigid grasses give way to more tender species; the arborescent mallows, euphorbias, and nettles, become shrubs, and subsequently herbs; the *Orchises* leave their aerial and epiphytic sites, and vegetate in the ordinary soil, and mosses and lichens occupy their stations on old or decaying trees; the fresh waters abound with *Confervæ;* and dead vegetables are covered with fungi.

(4928.) As the latitudes increase, the richness and abundance of the vegetation decreases. In the north temperate zone, the forests consist of birch, alder, willow, and fir, instead of the plane, the bread-fruit, and the mimosa; many trees and shrubs become herbaceous plants, so that wood either for building or fuel is scarcely known; and, although the grasses long strive against increasing cold, substituting one species for another as an approach is made towards the pole, they at length give way to lichens, which in Lapland and Iceland cover the boundless wastes, affording forage and pasture to the flocks and herds. In such situations, the words *corn*, and *wine*, and *oil*, are strange unmeaning sounds, or the names of foreign delicacies, of which travellers may have told, but which, to the common people, are any thing but ordinary articles of food.

(4929.) Such are some of the more general features of the vegetation in these several zones. Of the varied predominance of the different classes in each there is sufficient proof, but of their relative proportions the calculations are not complete. The following are some of the ratios made out with much labour by Humboldt, De Candolle, Brown, and others.

(4930.) Of 3880 flowering plants found within the tropics of the New World by Humboldt and Bonpland, 3226 were dicotyledonous, and 654 monocotyledonous; and the above, although only a third or a fourth, may be taken as a fair average of the whole. Of the monocotyledons, the *Palmales* and *Musales*, with the perigynous part of the *Liliales*, are much more frequent within than without the tropics; and the *Juncales*, with the hypogynous *Liliales*, are more common in extra- than intra-tropical latitudes. Hence, within the tropics of America, the monocotyledons are to the dicotyledons as 1 to 5; in equinoctial Asia, Africa, and Australia, the proportion is, according to the calculations of Brown, as 1

to 4; while cryptogamic or flowerless plants, compared with flowering ones, are found to exist in equatorial latitudes only in the proportion of 1 to 14, in the plains, or true equatorial climate, although in elevated situations, the ratio rises to 1-5th, so as to make them on an average as 1 to 8 or 9.

(4931.) In the temperate zones the proportion of mono- to di-cotyledonous plants does not vary so much as the plants vary in their port and habit. It is, however, reduced, and appears to be as 1 to 3 or 4, the abundance of rushes and grasses keeping up the number. But, on the other hand, here the cryptogamic tribes greatly increase their relative proportion, being indeed as high as 1 to 2: *i. e.* forming on an average one third of the entire vegetation, and in some places, as in Sweden, according to Wahlenberg, they are as 4 to 1. But Sweden is peculiarly rich in these plants, and they have there been more accurately and extensively examined than in most other countries; so that it is not an average example.

(4932.) In the frigid zone, or rather within the circumpolar regions, extending them somewhat beyond the arctic circle, the native dicotyledons are to the monocotyledons as 3 to 1, or as 2 to 5. The ratio varies however considerably according to the absence or presence of certain polar tribes, as *Saxifragaceæ*, *Brassicaceæ*, &c. In Iceland, according to Hooker, there are 239 exogenous plants to 135 endogenous ones; that is, including the ferns. And in Lapland, according to Wahlenberg, 340 to 157. But in Greenland, on the coasts of which the *Gramineæ* are very scarce, the proportion is, according to Brown, as 4 to 1; and in Spitzbergen the disproportion is still greater; while in Melville Island it is as 5 to 2. Hence 1 to 3 or 4 may be taken as their average in the frigid zone.

(4933.) In the circumpolar regions the cold-loving *Cryptogamic* plants abound, but perhaps their prevalence is owing as much, or more, to the extensive multiplication of individuals as to the increase of genera or species. This forms a reverse analogy with the flowering plants, the especial tribes of the warmer zones; for, where their individual prevalence is great, the number of species amongst any given number of individuals, or the number of genera amongst any given number of species, is less than in the frozen regions of the north, while here the contrary takes place with the same tribes, or the same thing with the contrary ones.

(4934.) In Iceland, according to Hooker, there are 263 cellular flowerless plants to the 135 *Endogenæ*, and 239 *Exogenæ* above mentioned; that is, about ½, which may be assumed to be their average proportion, although in many places the ratio is much higher. Thus, in Melville Island, they are as 58 to 67; that is, this single group is nearly equal to both the *Endogenæ* and *Exogenæ* combined; and in Sweden, as before observed, they are about 4 to 1; that is, the whole of the flowering tribes collectively only amount to one fifth, while the cellular plants alone form nearly four fifths of the entire vegetation.

(4935.) In conclusion, we may ask how far does the general geographical distribution of existing plants agree with the general geological positions in which the fossil remains of the vegetables of former ages are found? And whether these general comparisons throw any light on the former history of the globe, or of its organic productions, which the preceding views of each particular class has failed to afford?

(4936.) The confirmation which such a general view affords to the particular inferences drawn from the investigation of each separate class or individual group,

if not one of its more striking features, is far from being one of its least important uses. The cumulative argument is here of exceeding value; for, although the evidence with respect to the coincidence existing between the geographical and geological distribution and position of any special group might be sufficient for it, individually, even if nothing were known of co-relative proofs, yet the concurrent testimony of every class adds much force to the arguments built upon these facts, and renders what might at one time be considered a plausible hypothesis, a sound and rational theory.

(4937.) That certain tribes of existing plants abound or prevail in certain latitudes, and that certain fossil vegetables are found in certain strata, either exclusively, or most abundantly, admits not of question; and now, having the concurrent testimony of every class, it is not less certain that the different classes have borne different relative proportions to each other in different epochs, as they now do in different latitudes.

(4938.) Furthermore, the opinion seems established, that fossil plants which can be identified as belonging to recent species, are found in the superior or more recent strata; that fossils which are specifically distinct from any plants now existing, are discovered in the lower or older strata; and that when they cannot be referred immediately to any modern species or genus, their similitude is greatest, and their affinity (remote though it often be) is nearest, to plants now natives of the torrid zones; the fossils in question being however exhumed in cold or temperate regions, so that the idea of climatorial changes to a vast extent having occurred, which the different classes severally suggested, is, from the concurrent sanction of the whole, rendered more than probable.

(4939.) There are two other facts, of no slight importance, which such a general view reveals: first, that however prevalent certain tribes of existing plants may be in certain latitudes, and however rare in others, still that some representatives of each class, and of many of the larger and more important natural orders, are found both within and without the tropics: in the torrid, the temperate, and often in the frigid zone.

(4940.) And, secondly, the geological coincidence with the foregoing. For however partially the flora of preceding epochs may have been preserved, and however imperfectly we are yet possessed of the fragments that do remain, there does seem sufficient reason for believing, that although certain tribes in a fossil state prevail in certain strata, as recent ones predominate in certain latitudes, that representatives of the principal classes and of the most differently constructed plants existed in almost every great epocha since the creation. The *Fungi* and the *Fungoid Selanthi* are the principal exceptions, for the assumed absence of the grasses is questionable. None, it is true, have been found, or perhaps we should rather say, no grass has been positively identified in a fossil state. Thus, taking the apparent exceptions, even at the uttermost, they apply to a comparatively small portion of the vegetable kingdom, and the proof of their being exceptions is only negative and indirect; while the testimony, as to the existence of some representatives of at least six out of the nine classes, and those the largest classes, is direct and positive. These six classes likewise include examples of the most rude and simple, as well as of the most perfect and complicated forms.

(4941.) An inference to be deduced from these facts, a conclusion which indeed does seem inevitable, is, that the doctrine or hypothesis of progressive development is

altogether false; for, waving the objection, which is little else than a quibble, as to the comparative perfection or imperfection of beings which are every way fitted to perform their relative duties, and to fulfil the purpose of their creation, there are found in the same strata, and those some of the earliest in which organic remains are found, viz. the transitional and carboniferous series, examples of the so called imperfect, with others of the so called more perfect plants. Thus, even in the transition rocks, along with the *Fuci*, there have been discovered *Calamites*, and several representatives of foliaceous ferns, with examples of *Sigillaria*, *Lepidodendron*, *Stigmaria*, and *Asterophyllites*, the affinities of which with the mono- and di-cotyledons of the present day have already been shewn. In the carboniferous series, the relics of *Ferns*, *Pines*, and *Palms*, with numerous representatives of other *Exogenæ* and *Endogenæ*, such as *Cacti* and *Euphorbiaceæ*, and even perhaps of grasses, are most abundant, much more abundant than the simply cellular plants; for neither the *Muscites* nor *Confervites* occur in the infra-cretaceous strata, and the chief of the *Fucites* are found in the chalk or the beds above it. And furthermore, the *Fungi* and *Fungoid Selanthi*, which have not been found in a fossil state, and form the exception before adverted to, are confessed on all hands to be among the simplest in their structure of any plants existing; the right of the first named to be admitted amongst plants having been often doubted, while the second afford examples of the nearest approach that is made by any flowering vegetables to the simple cellular structure of the lowest tribes.

(4942.) Hence, as the most perfect, that is, the most complicated plants, were at least contemporaneous with the most simple or imperfect, and often antecedent in their existence, the idea once entertained by some speculative persons, of the gradual change or metamorphosis of one being into another, and the gradual conversion during an indefinite period of a *Conferva* or a *Fungus* into a *Moss* or a *Lichen*; of cellular and flowerless into tubivascular or flowering plants; nay, during an uncounted and uncountable succession of ages, of the change of inorganic lifeless matter into organized living beings; of plants into animals; of the lower animals into higher ones; and, finally, of brutes into men, is altogether untenable.

(4943.) Certain animals appear to have been at least coeval in their creation with plants; and, although it has been shewn that some of the simple cellular plants are among those of which we have the earliest memorials, still that with regard to others, as the *Musci*, the records of their existence cannot be traced to a very remote era; and of some, as the *Fungi*, the earliest history bears a very recent date.

(4944.) Still, the very early predominance of the flowerless ferns and the presence of the marine algæ in the earliest rocks in which traces of organic beings have been found, and the small relative proportion in these periods of flowering plants, at least of distinct species of exogenæ, however much some individuals of a peculiar character might abound, are general facts well worthy of observation; for, as an able writer in Jameson's Journal* has remarked, the succession in which they appear to have predominated has a most curious coincidence with the succession in which the different kinds of plants are mentioned in the Mosaic History of the creation.

* No. XXV. p. 65.

(4945.) But whether their successive prevalence does strictly accord with the succession in which they are named by Moses or not, and of which the proofs are scarcely conclusive, perhaps however merely because they are not complete, it is a most remarkable fact, that in a work written in so early an age, almost before the birth of Botany as a science; a work, be it remembered, not on natural history, nor written by a naturalist, but in which, if any references to plants occur, the mention is incidental, yet, that in such a work, and written at such a time, the classification of vegetables now generally adopted, and only of late universally received, should have been, not obscurely hinted, but, clearly and explicitly described.

(4946.) It is curious that a system which it has taken centuries to mature, and which successive botanists have laboured age after age to advance towards perfection, should be identical with that enunciated by Moses, and from which for so many thousand years naturalists had wandered more and more, and to which their return was wholly unpremeditated, as the identity was not recognized until after the return was made.

(4947.) The vegetable kingdom, it is well known, is now divided by common consent into three great regions; their names and synonymes, *A-*, *Mono-*, and *Dicotyledons*, or *Exogenæ*, *Endogenæ*, and *Cellulares*, (vide 21, 22), as well as their distinctive characters, are so familiar to most persons, that, even to repeat them, may sound like a truism. These primary divisions were called by Linneus, from their port and habit, *Plantæ*, *Fruges*, and *Cryptogama*, as well as di-, mono-, and a- cotyledons; and they have by others been termed, with more especial reference to their fruit or reproductive organs, SEED-*bearing*, GRAIN-*bearing*, and SPORE-*bearing* or SEEDLESS plants, which are merely English versions of Agardh's SEMINI*feræ*, GRANI*feræ*, &c. The lower series, including all the cryptogamic vegetables, even the ferns, have been considered seedless, because they are reproduced either by portions separated from their general substance, or by small grumous masses called spores, which have more resemblance to buds than seeds, they germinate from no fixed points, and are destitute of an embryo, the essential organ of a grain or seed. Hence these, which include all the flowerless tribes, are called *Exembryonatæ*, *i. e.* *seedless* plants, by Richard.

(4948.) The second series, including the grasses, sedges, rushes, lilies, palms, &c. although furnished with flowers, and bearing seeds having perfect embryos, have this embryo but 1-lobed, *i. e.* mono-cotyledonous, and such unilobate seeds are most frequently, as in all the grasses, sedges, and many other plants, invested only with a tight obscure pericarp, so that they have been considered naked, and called *grains*, to distinguish them from other seeds which, besides a 2-lobed, or di-cotyledonous embryo, have a loose and fleshy, and often eatable pericarp, such as the apple, the orange, and the plum, which, for the sake of distinction, have been termed fruits. Now these *seedless* or *spore*-bearing, these *grain* or simple *seed*-bearing, and these *seed*-vesselled or *fruit*-bearing plants, which have just been shewn to be equivalent to the A-cotyledons, Monocotyledons, and Di-cotyledons of Linneus, Jussieu, and all modern botanists, are at the same time most peculiarly coincident with the three primary divisions hinted at by Moses. In the Book of Genesis we read that it was in the third epoch, or day, that vegetables were created. In our vulgate the account runs thus: "God said, let the earth bring forth *grass* (DESHA), and the *herb* (OESHEB) yielding *seed*, and the *fruit-tree* (ETZ) yielding *fruit* after his kind, whose *seed* is

in itself, upon the earth, and it was so." "And the earth brought forth *grass* (DESHA), and the *herb* (OESHEB) yielding *seed* after his kind; and the *tree* (ETZ) yielding *fruit*, whose *seed* was *in itself*, after his kind."

The words *etz* or *otz*, and *oeseb* or *oesheb*, have been very well rendered by "*herb yielding seed*," and "*tree yielding fruit whose seed is in itself;*" but the translation of *desha* or *deshe* is far less happy; in the text it is rendered "*grass*," in the margin "*tender grass*," and this marginal note renders it probable that some difficulty occurred, or that some doubt was entertained of the strict propriety of the version. "In the terms *tree* and *herb* we find, (as the anonymous writer already referred to observes,) a recognition of a remarkable natural distinction among the vegetable tribes, and this very circumstance would lead us to infer that the first term (which has obviously presented a difficulty to our translators, since they have given two interpretations of it,) is intended to express some class or tribe of the vegetable kingdom, as naturally distinguished from herbs and trees as they are from one another. The term in question (*deshe*) is a noun from a verb, of which, from Joel ii. 22, we learn the meaning is *to spring, to shoot, to vegetate*, 'Be not afraid, ye beasts of the field, for the pastures of the wilderness *do spring*' (*dasheu*). In the 11th verse under consideration, we find both the verb and the noun, for the words translated '*Let the earth bring forth*,' are *tadeshe haaretz*, which, in accordance with the obvious sense in Joel, would be better rendered, '*Let the earth shoot out.*' From this meaning of the verb, then, the noun would signify the *springing* or *shooting plant*, and, as used here, in contradistinction to both herbs and trees bearing seeds, it is surely not recommending any forced interpretation to suggest, that it is meant to express that class of vegetables which are by botanists recognised as being naturally distinguished by the obscurity of their means of reproduction," plants which are called seedless both by the learned and the simple, and which the earth does literally *shoot out;* whence indeed the idea of their equivocal or fortuitous generation sprang.

(4949.) This version is corroborated by the fact that *deshe* is not the Hebrew word for *grass*. The term for grass, the common food for cattle, is *chatzir*, which name lexicographers have shewn to have reference to its tubular structure. Thus, in Job xl. 15, we read, "he eateth *grass* (chatzir) as an ox;" and, Psalm civ. 14, "he causeth *grass* (chatzir) to grow for the cattle." In several passages, besides this of Genesis, we find *deshe* contradistinguished from both *oeseb* and *chatzir*, as in Deut. xxx. 2. "As the small rain upon the *tender herb* (deshe), and as the showers upon the *grass*" (oeseb); and, Psalm xxxvii. 2, "They shall soon be cut down as the *grass* (chatzir), and wither like the *green herb*" (deshe); and, 2 Kings xix. 26, "They were as the *green herb* (deshe), as the *grass* (chatzir) on the house-tops." These quotations shew the want of uniformity with which the English translators have rendered these terms, and go to support the sense we would assign to it.* And, furthermore, they prove that the deshe or tender herb of the Hebrews was something very different from *grass*, their *chatzir*, and natu-

* Three passages, the first, in the 23d Psalm, the second, in Job vi. 5, and the third, in Jeremiah i. 11, in which this word *deshe* occurs, and in which it has been rendered *grass*, have been supposed to militate against the foregoing conclusion; but, from the contexts, as in the previous cases, they are shewn to be either erroneous versions, or confirmatory of the above view, when properly considered.

rally contradistinguished from their *oeseb* and *etz;* and therefore, as these latter comprised all seed-bearing and fruit-bearing plants, the only others which their deshe could signify, are the seedless ones.

(4950.) Geological researches, as already hinted, have been thought by some persons to afford no slight corroboration of the general belief that the sequence, observed in the Mosaic account of the Creation, is indicative of the order pursued by the Creator, in bidding each tribe of created things to be. Whether the relative position in which fossil remains are found may confirm this opinion or not, future investigators must determine. The evidence hitherto collected, although curious in the extreme, and oftentimes surprisingly coincident, seems as yet to be insufficient to be held conclusive on a point of so much importance. For such a problem demands for its satisfactory solution not only a much more perfect knowledge than we at present possess of extinct and existing plants, but also requires a similar knowledge of extinct and existing animals, as well as a minute acquaintance with the history of the inorganic world, nay, even of the universe at large. Hence it is rather the extent of the inquiry than dissatisfaction with the proofs collected,—which, as before observed, may perhaps be unsatisfactory merely because they are incomplete,—that precludes its discussion here. To isolate those parts which have reference to the vegetable kingdom would injure and weaken the general argument; and, to introduce the whole, would be to open a new and most extensive question, altogether irrelevant to our present theme.

(4951.) The two points, however, which the foregoing general considerations have tended to corroborate and confirm, are not without their value. The coincidence between modern botanical systems, and the earliest methodical arrangement of vegetables of which we have any record, is more than archæologically interesting. And the negation thus put upon the wild hypothesis of spontaneous evolution and perfectibility, is a signal triumph of inductive philosophy; for the general inference previously arrived at, is now directly proved in the especial case: and the opposite assumption at once shewn to be, not only adverse to reason, but contrary to truth—not only logically absurd, but historically false.

(4952.) The determination of this latter point is indeed an achievement of no mean importance; for even had the doctrine thus triumphantly refuted been as strictly true as it is altogether false, a philosophy so cold, repulsive, and appalling, would, notwithstanding its surreptitious grandeur, have been a sad exchange for the ardour of enthusiasm and warmth of gratitude nurtured by true wisdom, which ceases not to believe and adore, when it ceases to comprehend. True wisdom bids her disciples search into the mysteries of nature, as far as nature's ways are penetrable by man; but, although they scorn to hoodwink reason, they perceive and acknowledge that there is no surer sign of rationality than the forbearing to torture reason with inquiries beyond its scope and ken. True wisdom teaches that, besides the things which are revealed, there yet remain secrets, which belong not to us or to our children: still the knowledge attained and attainable by them is great; and they love not less because they know not more. And how different must be the feelings of one, who sees in all the mechanism and adaptations of the universe but the effects of chance, the results of a blind impulse of mutation, from those with which the self-same wondrous works are beheld by him who traces throughout the whole creation the finger of the great Creator: the former misinterprets the book of nature, and reads therein a melancholy tale, by which he is taught, not in humility, but in despondence, to "say unto corruption, thou art my father, and unto the worm, thou art my sister and

my mother;" while, to the latter, the heavens and the earth, and all that they contain, become narrators of the wisdom and benevolence of HIM who made them. Yes; for, although there is neither speech nor language (by reason's ear), voices are heard among them: and the true philosopher, instead of bewildering himself in unsound metaphysical speculations as to original entity;—the self-existence, independence, and eternity of matter;—equivocal generation, and the possibility of life being the result of organization;—the spontaneous development of organs according to the (unfelt and unperceived) wants and desires of individuals;—the conversion or metamorphoses of each into the other; of lifeless matter into monads, of plants into animals, and of brute animals into men,—perceives, even in those things which the least are understood, sufficient evidence of design to forbid their production to be attributed to chance: he recognizes at once proofs of skill in the design, that he cannot fathom; and of power in its execution, that he can neither measure, nor comprehend. Yet, although incomprehensible, and hence, to some a stumbling-block, and to others foolishness, he beholds in these obscurities many sure manifestations of a wisdom without limit, and of a power without control. Yes, these clouds, which bound the horizon of human knowledge, are clouds of witnesses, for o'er their darkness he sees extended a bow of promise, a standard of the Deity; and therefore, joining in the common theme of praise, with mingled sensations of gratitude and love, he humbly yet confidently declares, "MY FATHER *made them all.*"

GENERAL TABULAR CONSPECTUS OF THE CRESCAFFINES.*

	Classes.	Orders.
CRESCAFFINES. Exogenous, stratified, tubivascular (rarely subcellular) flowering plants.	SELANTHI OR CYTINARES. Subcellular, leafless, flowering, fungoid parasites.	CYTINALES. Ovules many, embryo divided (or dicotyledonous.)
		CYNOMORIALES. Ovule solitary, embryo undivided (or monocotyledonous.)
	ROSARES OR EUCARPÆ. Tubivascular, reticostate, angiospermous exogenæ.	SYRINGALES. Flowers dichlamydeous and synpetalous.
		ROSALES. Flowers dichlamydeous and apopetalous, rarely a- or cata- petalous.
		QUERNEALES. Flowers a- or monochlamydeous.
	PINARES OR ZAPINI. Tubivascular, linearicostate, gymnospermous exogenæ.	PINEALES. Stem divided, leaves simple, secretions resinous.
		ZAMIALES. Stem simple, leaves divided, secretions mucilaginous.

* The ascending series having been followed in the preceding general descriptions, the arrangement in the tables is consequently the same; *i. e.* from the bottom of the page upwards.

Orders.	Sections and subsections.	Types and subtypes.	
QUERNEALES.	EUPHORBINÆ. A- mono- di- chlamyd., per. imbricate (usually), free, alb. fleshy, embryo straight., infl., not amentaceous, fl. with a trine disposition.	*Empetraceæ.*	Non-lactescent, supr. ovary, ascendg. seeds, watery alb.
		Euphorbiaceæ.	Lactescent, variable perianth, germen free, ovules def., pend. alb. oily, testæ carunculate, radicle superior.
		Buxidæ.	Seeds 2.
		Euphorbidæ.	Seeds solitary.
		Begoniaceæ.	Non-lactescent, inf. winged ovary, indef. seeds, striated testæ.
	RUMICINÆ. Stems mostly herbaceous, leaves simple; perianth often colored and imbricate, germen free, albumen mealy, rarely evanescent, embryo curved.	*Polygonaceæ.*	Stipules ocreate or sub-ocreate, seed solitary, erect, emb. inverted, radicle superior.
		Nyctaginaceæ.	Exocreate, per. hardened, plicate, ovary 1-celled, seed erect, radicle inferior.
		Scleranthaceæ.	Per. herbaceous, stam. opp., def., perig.; seed 1, pendulous, funicle long.
		Betaceæ.	Per. herb. or petaloid, stam. 5 or less, opp., germ. 1-celled, seed 1 or more, erect.
		Amarantidæ.	Fl. shewy, per. coloured, involucrate, stam. often connate, seeds 1 or more, alb.
		Chenopodidæ.	Fl. inconspic., per. herba. and ebracteate, stam. free, seed 1, alb. sometimes evanescent.
		Petiveriaceæ.	Ab-involucrate, stam. alt., 5 or more, rad. inf., seeds sol., erect.
		Phytolaccidæ.	Leaves exstip., ovary 1-10-celled, stigmas terminal, alb. evident.
		Petiveridæ.	Stipulate, ovary 1-celled, stig. lateral, alb. evanescent or abortive.
	ASARINÆ. Stam. monadelph. or epigynous, ovaries many-celled, ovules indefinite, seeds albuminous, embryo included.	*Nepenthaceæ.*	Stam. hypog. and monadelph., perianth imbric. emb. 2-lobed, leaves ascidiate.
		Aristolochiaceæ.	Stam. epig., per. valvate and synsep., emb. undivided, leaves simple.
		Asaridæ.	Stamens free.
		Aristolochidæ.	Stamens gynandrous.
	PIPERINÆ. Infl. spadiciform, fl. achlamyd., emb. included, vitellus in general persistent.	*Chloranthaceæ.*	Leaves opp., petioles sheathing, ovule solitary and pendulous, vitellus obsolete.
		Piperaceæ.	Leaves opp., exstip., ovary 1-celled, seeds sol., erect, vitellus persistent.
		Saururaceæ.	Leaves alt., stipulate, ovary 2-4-celled, ovules ascending, vitellus persistent.
	HIPPURINÆ. Herbaceous or suffruticose aquatics, with variable cotyledons, either very small, unequal, or numerous.	*Ceratophyllaceæ.*	Ovary free, seeds exalb., cotyled. 4, plumule compound.
		Trapaceæ.	Germen inf., seeds exalb., cotyled. 2, very unequal.
		Hippuridaceæ.	Germen inf., seeds albuminous, cotyled. 2, very minute.
		Callitrichidæ.	Bracteæ 2, petaloid, limb of calyx abortive, stam. 1-2, anth. 1-celled, seed sol. and peltate.
		Hippuridæ.	Limb of calyx small, entire, stam. 1, anth. 2-celled, frt. 1-celled, 1-seeded.
		Haloragidæ.	Limb of calyx parted, pet. sometimes developed, stamens more than 2.
	LAURINÆ. Trees or shrubs, rarely herbs, without stipules, inflorescence not amentaceous, perianth colored, flowers mostly united, fruit 1- or many-seeded, alb. none, or when present not mealy, but either fleshy or ruminated, and the embryo straight.	*Terminaliaceæ.*	Calyx sup., valvate and deciduous, ovary inf., 1-celled, seeds def., pend., exalb., cotyled. spiral.
		Santalaceæ.	Calyx valv., mostly sup., ovar. 1-celled, seeds solitary, exarillate, and albuminous.
		Santalidæ.	Ovar. 3-ovuled, 1-seeded by abortion, embryo round.
		Nyssidæ.	Ovar. 1-ovuled, 1-seeded, emb. not cylindrical, cotyled. foliaceous.
		Osyridæ.	Ovar. free and superior, perianth 3-cleft.
		Penæaceæ.	Ovar. sup., 4-celled, ovules def., emb. homogeneous.
		Proteaceæ.	Per. inf., 4-lobed, valvate, stam. opp., def., seeds def., erect, exalb., rad. inf.
		Thymelæaceæ.	Per. inf., imbric., ovar. free, 1-celled, 1-seeded, seeds exaril., exalb. or subalb.
		Elæagnidæ.	Leaves and perianth scaly, sepals persistent covering the fruit, stam. alt., ov. and emb. erect.
		Thymelidæ.	Leaves smooth, perianth colored, not covering the frt., Stam. opp., ov. pend., emb. inverted.
		Hernandiaceæ.	Flowers involucellate, cal. inf., tubular, decid., seeds sol., pend. exalb. cotyled. lobed.
		Myristicaceæ.	Fl. diœcious and ternary, stam. def., monadelph., seeds arillate, alb. ruminated.
		Lauraceæ.	Ovar. sup., ovule solitary, pend., anthers dehiscing by recurved valves, seeds exalb. and exarillate.
		Cassythidæ.	Leafless, herbaceous, insipid.
		Lauridæ.	Leafy, arborescent, aromatic.
	URTICINÆ. Inflorescence amentaceous or subamentiform, flowers separated (rarely united), ovaries superior, and seeds albuminous.	*Monimiaceæ.*	Fl. sessile, involucrate, lvs. opp., exstip. anth. bursting lengthwise, alb. abundt., ovar. several, 1-celled, 1-ov.
		Atherospermidæ.	Anth. dehisce by recurved valves, seed erect, rad. inf.
		Amboridæ.	Anth. open by a single chink, seed pend., rad. sup.
		Datiscaceæ.	Non-lactescent, leaves alt., exstip., fl. reg. monœcious, ovar. 1-celled, hiant., pl. parietal, many-seeded.
		Urticaceæ.	Non-lact., frt. free, distinct, seeds in general erect and solitary, emb. mostly straight, rad. superior.
		Lacistemidæ.	Stam. lateral, anth. dehisce transversely, seeds pend. and arillate, alb. fleshy.
		Cannabidæ.	Stam. straight in æstiv., not irritable, emb. curved or spiral.
		Urticidæ.	Stam. opp., induplicate, and irritable, anth. dehisce lengthwise, emb. straight.
		Platanaceæ.	Inf. subament., ovar. embedded or included, ov. pend. emb. mostly curved, leaves alternate and stipulate.
		Antiaridæ.	Lactescent monochlamyd., fl. solitary, nuts invested.
		Artocarpidæ.	Lactescent monochlamydeous, inflor. congested.
		Platanidæ.	Non-lactescent achlamyd., monandrous congested fl.
		Stiluginaceæ.	Inf. subamentiform anth. dehiscing transversely, ovul. collat. and pend., embryo green, cotyl. leafy.
	ULMINÆ. Infl. subamentiform, flowers united, seeds exalbuminous, leaves alternate.	*Aquilariaceæ.*	Calyx furnished with 10 petaloid scales or barren fl., stam. 10, fertile.
		Chailletiaceæ.	Stam. 10, 5 barren and petaloid, 5 fertile, cotyled. fleshy.
		Ulmaceæ.	Stam. 5, all fertile, cotyled. foliaceous, leaves scabrous.
	QUERCINÆ. Infl. amentaceous, flowers separate, albumen 0. — CORYLIANÆ. Ovary inf.	*Juglandaceæ.*	Ovules def., erect, cotyled. wrinkled, leaves pin., exstip.
		Corylaceæ.	Bracteæ cupulate, ovar. inf., ovul. pend., coty. smooth.
	BETULIANÆ. Ovary sup.	*Betulaceæ.*	Leaves present, germ. 2-celled, ovules def,, pend., testæ downless.
		Salicaceæ.	Leaves present, seeds indefinite and comose.
		Myricaceæ.	Leaves pres., branches exarticulate, ovul. sol. and erect.
		Casuarinaceæ.	Leaves absent, branches articulate, ovul. sol. and erect.
ZAMIALES.	Taxinæ. Cupressinæ. Abietinæ. — Stems divided, leaves simple, resiniferous.	*Taxaceæ.*	Pistilline flowers distinct and solitary, fruit a taxule.
		Thujaceæ.	Pistilline flowers erect and congested, fruit a galbule.
		Pinaceæ.	Pistilline flowers reversed, fruit a true scaly cone.
PINEALES.	Cycadinæ.	*Cycadaceæ.*	Stems simple, leaves divided, vernation gyrate, secretions mucilaginous.

Suborders.	Sections and subsections.	Types and subtypes.	
ROSALES. MYRTOSÆ OR PERIPETALÆ.—CALYCIFLORÆ OR *Perigynous Apopetalous Dicotyledons.*	CUCURBITINÆ. Amphi- syn- petal. cor., separated flowers, 1-celled ovaries, parietal placentæ.	*Papayaceæ.*	Synpet. cor. sup. fruit, alb. seeds, unbranched arboreous stems, and lactescent sap. [lactescent.
		Cucurbitaceæ.	Amphipetalous cor. inf. fruit, exalb. seeds, and not
		Cucumidæ.	Tendrils lat. and stipular, fl. mon- di- œcious or united.
		Feuillidæ.	Tendrils axillary and peduncular, flowers diœcious.
	GROSSULINÆ. Petals faucial, germen inferior (rarely free), 1-celled, with parietal placentæ, seldom 2-celled, with the placentæ central.	*Loasaceæ.*	Calyx adnate or girding, stam. indef., some sterile, placentæ 3-7, and sutural.
		Turneraceæ.	Exstip. excirrhose, pet. contorted, stam. def., caps. 3-valved, placentæ 3, and parietal.
		Passifloraceæ.	Subcorollaceous, nect. radiant, torus stipitiform and staminif., pl. def., many-seeded, alb. scrobiculate.
		Malesherbidæ.	Pet. 5, convolute, nect. annular, styles long, non-scandent, excirrhose. [scandent and cirrhose.
		Passifloridæ.	Pet. 0, or indeterminable, ovar. stipitate, stems often
		Paropsidæ.	Pet. 5, ovar. subsessile, stems non-scan., and excirrhose.
		Homaliaceæ.	Subcorollaceous, nect. glandular or scaly, ovar. half-inf., pl. def., impunctate leaves. [st., punctate lvs.
		Samydaceæ.	Apet. or subpetalous germ free, def. pl., monadelph.
		Grossulaceæ.	Non-succulent shrubs, distinct and def. sep., pet., stam., and placentæ. [pet., many stam. and placentæ.
		Nopalaceæ.	Succulent shrubs indef., and undistinguishable sep. and
	CRASSULINÆ. Sepals imbricate, rarely valvate, carpels definite, distinct at summits, seeds albuminous and many (seldom few), leaves fleshy or subsucculent.	*Fouquieriaceæ.*	Synpet. cor., tube long, caps. 3-celled and loculicidal, seeds winged, emb. straight.
		Portulaceæ.	Sep. mostly 2, pet. few or 0, tube when present short, stam. few, seeds wingless, emb. curved.
		Mesembraceæ.	A- or poly- pet., stam. num., 5 or more, carpels concrete, emb. various. [mealy, emb. straight.
		Reaumaridæ.	Leaves alt., small, scale-like, pet. 5, stam. hypog., alb.
		Nitraridæ.	Leaves alt., pet. 5, alb. 0, emb. straight.
		Mesembryanthidæ	Leaves opp., cor. a- or poly- pet., alb. mealy, emb. curved or spiral. [free, emb. straight.
		Crassulaceæ.	Cal. free, st. def., carpels equal to sep. and pet., mostly
		Crassulidæ.	Mostly succulent, cor. often catapet., stam. irreg., carp. discrete, styles terminal. [minal, leaves ascidiate.
		Cephalotidæ.	Apetalous, st. alternately longer and shorter, style ter-
		Galacidæ.	Apopet., st. alt. barren and fertile, style 0, carp. concrete.
		Saxifragaceæ.	Sepals few and imbricate, carpels connate, seeds many, emb. straight, radicle short and hilose, stip. 0.
		Hamameliaceæ.	Stipulate, pet. involuto-valvate, ovar. 2-celled, half-inf., seeds sol. [bric., carp. concrete, seeds indef.
		Hydrangeaceæ.	Stem shrubby, leaves opp., exstip., sep. valv., pet. im-
		Hydrangidæ.	Stam. few, seeds exarillate, testæ reticulate.
		Philadelphidæ.	Stam. many, seeds arillate, testæ smooth.
	ONAGRINÆ. Leaves simple (mostly opp.) and exstipulate, sepals valvate, germen symmetrical, 1-4-celled, adnate (rarely free), seeds albuminous or subalbum., (rarely exalbuminous) and emb. straight.	*Circæaceæ.*	Disepalous, dipetalous, diandrous, ovar. inf., 2-celled, ovules def., erect. [many, placentæ central.
		Onagraceæ.	Sep. 4, pet. 4 or 10, contorted, germ. 2-4-celled, seeds
		Lythraceæ.	Inflor. thyrsoid, sep. free, valv. or sub-valvate, capsule membranous and invested. [inf., 1-celled, 1-seeded.
		Rhizophoraceæ.	Lvs. opp., with intrafol. stip., sep. valvate, germ. half-
		Vochyaceæ.	Flowers irreg., calyx spurred and imbricate, pet. and stam. variable in size and number, but defin.
		Combretaceæ.	Fl. reg., sep. valvate, ovar. inf., 1-celled.
		Combretidæ.	Seeds exalbumin., cotyledons thick and plaited, pet. 4-5.
		Alangidæ.	Seeds albumin., cotyled. flat, pet. 6-10, linear, anthers long and protruded.
	MYRTINÆ. Leaves simple and exstipulate, sepals imbricate, rarely valvate, flowers regular and united, carpels usually concrete, seeds exalbuminous, cotyledons often joined.	*Melastomaceæ.*	Leaves opp., 3 or pluricost., impunct., stam def., anth. long and inflex., seeds indef. [cotyled. convolute.
		Memecylaceæ.	Lvs. opp., unicostate, impunct., anth. long and inflexed,
		Gustaviaceæ.	Leaves alt. and impunctate, with intromarginal costules.
		Myrtaceæ.	Leaves aromatic, opp., punctate, intromarg. costules, stam. many, anth. small. [cynarhodon or balaust.
		Punicaceæ.	Leaves impunctate, calyx urceolate, persistent, fruit a
		Granatidæ.	Stem uniaxial, branches spiny, leaves smooth, subpunctate, frt. a balaust. [extrorse, frt. a cynarhodon.
		Calycanthidæ.	Multiaxial, spines 0, leaves scabrous, impunctate, anth.
	ROSINÆ. Leaves stipulate, sepals 5, the fifth axial or posterior, fruit a drupe, pome, or akenium, (not a legume,) seeds exalbuminous, embryo straight.	*Sanguisorbaceæ.*	Pet. 0, cal. persist., indurated, inclosing a solitary dry carpel, ovule susp. [follicular and pluriovulate.
		Spiræaceæ.	Calyx ebracteate, fl. a- or polypet., styles terminal, frt.
		Quillajidæ.	Arborescent, sepals valvate, follic. connate below, cotyledons leafy. [thickish.
		Spiræidæ.	Herbs or shrubs, sep. imbric., follic. discrete, cotyled.
		Rosaceæ.	Cor. polypet., ovar. simple & superior, styles lateral, frt. akenia or drupeolæ. [herent, ovu. def. & collateral.
		Pyraceæ.	Cal. mostly adherent, frt. inf. and pomaceous, carp. co-
		Prunaceæ.	Carpels free and superior, fruit drupaceous.
		Amygdalidæ.	Cal. decid., 5-toothed, pet. reg., style term., seeds pend., rad. superior. [or absent, style basal, seeds erect.
		Chrysobalanidæ.	Cal. persistent, coherent on one side to germ, pet. irreg.
	CICERINÆ. Leaves stipulate, and compound, sepals 5, the fifth ab-axial, frt. a legume or loment, rarely drupaceous. *MIMOSIANÆ.* Embryo straight, radicle hilose.	*Detariaceæ.*	Sepals valvate, pet. 0, fruit drupaceous.
		Mimosaceæ.	Sep. valv., cor. reg., and stam. hypog. or subperigynous.
		Cassiaceæ.	Sep. imbric., cor. irreg. or sub-reg., stam. irreg. & perig.
		Cæsalpinidæ.	Stam. free, corolla not papilionaceous.
		Geoffroyidæ.	Stamens connate, corolla papilionaceous.
	LOTIANÆ. Emb. curved, rad. hilose.	*Swartziaceæ.*	Sep. valvate, stam. and pet. when present hypog, cor. irreg. or obsolete.
		Lathyraceæ.	Fl. papiliona., seed-lobes fleshy, and often hypogæan.
		Lotaceæ.	Fl. papilionaceous, seed-lobes leafy and epigean.
	CONNARIANÆ.	*Connaraceæ.*	Emb. straight, rad. abhilose, stip. 0, fl. reg., ovules collateral.
	TEREBINTHINÆ. Mostly resiniferous, leaves exstip. and dotless, sepals imbricate, seeds exalbuminous, rad. hilose.	*Burseraceæ.*	Resinous, disk annular, carpels sup. and concrete, ov. 2 and collateral. [concrete, seed 1, and pendulous.
		Spondiaceæ.	Non-resinous, disk annular and large, carpels superior,
		Cassuviaceæ.	Resinous, torus expanded, carp. 1-seeded, seed pend. from basal funicle.
		Sumachidæ.	Seed-lobes foliaceous.
		Pistacidæ.	Cotyledons thick and fleshy.
	ILICINÆ. Leaves impunctate, mostly simple, sepals imbricate (rarely valvate), stamina definite, carpels few, seeds albuminous, emb. straight.	*Rhamnaceæ.*	Lvs. simp., stipulate, sep. valv., pet. sometimes absent, stam. opp. pet., seed 1, erect. [celled, seeds 1-2, pend.
		Bruniaceæ.	Calyx half adherent, imbric., stam. alt. pet., frt. 1-3-
		Celastraceæ.	Sep. imbric., rarely valv., pet. free, disk staminif., stamens alt. pet., ovar. superior. [and albuminous.
		Aquifoliaceæ.	Cal. imbric., cor. catapet., germ, sup., seeds exarillate
		Aquifolidæ.	Stip. 0, cor. hypog. staminif. ovary truncate, fleshy, seeds pend. [ovarium lobed, fruit dry, seeds erect.
		Stackhousidæ.	Leaves stip., cal. staminif. and corollif., styles lateral,

Suborders.	Sections and subsections.	Types and subtypes.	
ROSALES. Part of RHÆADOSÆ OR HYPOPETALÆ(3475.) THALAMIFLORÆ or *Hypogynous Apopetalous Dicotyledons.*	RANUNCULINÆ. Sep. and pet. imb., stam. mostly indef., carp. in general numerous and discrete, alb. large, emb. small and sometimes vitellose.		
	BERBERIANÆ. Fruit drupaceous or baccate, stam. opp. petals.	*Menispermaceæ.*	Stems scandent, leaves cordate or peltate, fl. small and separate, amphipet., emb. curved.
		Berberaceæ.	Stems non-scandent, fl. united, st. opp. pet. & sep., anth. dehisct., by recurved valves, seeds alb., emb. straight.
	RANUNCULIANÆ. Stam. many, carp. in general indef., multiseriate, and distinct, emb. not vitellose.	*Anonaceæ.*	Lvs. exstip., anth. rimose, carpels free or connate, alb. ruminated.
		Magnoliaceæ.	Lvs. stip., sep. caducous, anth. long, adnate, carpels distinct.
		Magnolidæ.	Lvs. impunctate, carpels indefinite.
		Illicidæ.	Lvs. pellucido-punctate, carpels definite and uniseriate.
		Dilleniaceæ.	Lvs. sempervirent, stip. 0, sep. persistent, anth. adnate introrse, seeds arillate.
		Ranunculaceæ.	Lvs. exstip., petioles dilated, sep. and pet. decid., anth. extrorse, arillus 0, alb. horny.
		Pæoniaceæ.	Lvs. exstip. anth. introrse, emb. lodged within the alb.
		Pæonidæ.	Lvs. deeply cleft, petioles sheathing, non-aquatic.
		Cabombidæ.	Lvs. broad and lobed, pet. not sheathing, aquatics.
	NELUMBIANÆ. Aquatics with prostrate stems, sep., pet., and stam. ambiguous, embryo vitellose.	*Nelumbiaceæ.*	Carp. discrete, simple, embedded in a fleshy torus, alb. 0, emb. large and vitellose.
		Nymphæaceæ.	Carp. concrete, fruit many-celled, many-seeded, alb. mealy, emb. small and vitellose.
	RHÆADINÆ. Germen symmetrical and free, carpels several and concrete, plac. intervalvular and mostly parietal.	*Sarracenniaceæ.*	Lvs. ascidiate, stam. indef. and discrete, stig. foliaceous and peltate, carp. concrete, seeds indef. and alb.
		Papaveraceæ.	Lactescent, cauline lvs. alt., sep. 2, pet. 4, equal, rarely 0, st. free, ovar. 1-celled, seeds alb.
		Fumariaceæ.	Non-lact., sep. 2, pet. 4, irreg., stam. mostly diadelph., seeds black, shining, arillate and albumin.
		Brassicaceæ.	Infl. ebracteate, cor. cruciform, stam. 4, dynam., pl. opp. stig., seeds exalb.
		Capparidaceæ.	Infl. bracteate, cor. cruciform, st. def. or indef., rarely 4 dynam., pl. intervalv., alb. 0.
		Resedaceæ.	Pet. laciniate or 0, æstiv. of calyx and cor. open, frt. 1-celled and hiant., pl. 3.
		Polygalaceæ.	Sublact., fl. irreg., 5th sep. axial frt. 2-celled, carpels incumb., seed sol. and caruncnlate, [2-celled, 1-2-sd
		Tremandraceæ.	Shrubs, fl. reg., sep. valv., pet. involute, stam. 8-10, discrete, anth. open by pores, seeds alb. and caruncul.
	RUTINÆ. Juices balsamic or resinous, lvs. mostly punctate and exstipulate, sepals imbricate, stam. def., and layers of pericarp separating or easily separable.	*Amyridaceæ.*	Lvs. opp., compd, fl. 4-nary, carp. distinct and simple, seeds sol., exalb.
		Olacaceæ.	Lvs. alt., simple, entire, or 0, fl. unsym., pet. bifid and nectarif., pl. central, seed 1, pend. and alb.
		Aurantiaceæ.	Lvs glabrous, alt., compd. (mostly), fl. sym., pet. exunguic., seeds many, exalb. and chalazous, frt. hesperid :
		Rutaceæ.	Lvs. variable, pet. sometimes concrete, st. def., styles gynobasic, seeds 2, pend., emb. straight, rad. inf.
		Zygophyllidæ.	Lvs. opp., dotless, stipulate, carp. connate, dehiscent from upper angles.
		Rutidæ.	Lvs. alt., dotted, stip. 0, carp. often distinct and dehiscent elastically.
		Simarubidæ.	Lvs. alt., dotless, stip. 0, carp. discrete, drupaceous, indehiscent.
		Ochnaceæ.	Non-resinous, lvs. mostly alt. and stip., fl. reg., carp. whorled, disk succulent, seeds solitary.
		Ochnidæ.	Lvs. alt. and stip, fl. with 5-ary disposition, seeds erect and exalb., cotyled. thick.
		Castelidæ.	Lvs. alt. and stip., fl. with 4-nary dispos., seeds inverted, alb. fleshy, cotyl. leafy.
		Coriaridæ.	Lvs. opp. and exstip., fl. with 5-ary dispos., seeds pend. and exalb., cotyl. fleshy.
	ACERINÆ. Juices non-resinous, leaves impunctate, sepals imbricate, pet. and disk hypogynous, stam. def., rarely indef., carp. 2 or more, sub-connate or coherent, and seeds in general without album.	*Sapindaceæ.*	Fl. unsym., a- or poly- pet., nect. villous or glandular, st. irreg., carp. 2-3, seed def.
		Æsculaceæ.	Stems arboreous, lvs. digitate, stip. 0, fl. irreg., pet. naked, carp. connate, emb. large, alb. none.
		Rhizobolidæ.	Stam. indef., fil. connate, germ. 4-celled, 4-ovuled, cot. small, rad. large.
		Hippocastanidæ.	Stam. def., fil. free, germ. 3-celled, hilum broad, cotyl. large and conferruminous.
		Aceraceæ.	Lvs. simple (rarely pinnate), fl. reg., a- or apo- pet., stam. def., samara 2-celled, seeds erect.
		Malpighiaceæ.	Lvs. simple, fl. symmet., a- or apo- pet., sep. persist., stam. def., carp. connate, ov. solitary.
		Malpighidæ.	Pet. unguiculate, but without appendages, disk and styles present, alb. 0.
		Erythroxylidæ.	Pet. dilated and nectariferous, disk 0, stig. sessile, alb. corneous.
		Hippocrateaceæ.	Lvs. simple, opp., pet. entire and simple, disk staminif., frt. wingless, seeds erect, alb. 0.
		Brexiaceæ.	Lvs. simple, stam. def. and hypog., carp. concrete, plac. axial, seeds many.
		Pittosporidæ.	Stip. 0, disk obsolete, frt. capsul. or baccate, seeds alb. and invested with pulp.
		Brexidæ.	Stip. small, deciduous, disk staminif., frt. drupaceous, albumen 0.
ANGELICOSÆ OR EPIPETALÆ.	ARALINÆ. Valvate petals broad at base, frt. not separable, inflor. umbellate.	*Corneaceæ.*	Four petals, 4 stamens, seeds solitary and pendulous, radicle shorter than cotyl., leaves opposite.
		Araliaceæ.	A- or poly- petalous, 5 or more stam., 2-15-celled fruit, long radicle, alt. leaves.
	ANGELICINÆ OR UMBELLIFERÆ. Involute or subimbricate petals, narrow at the base, carpels 2 and separable, inflor. umbellate.	*Coriandraceæ.*	Cœlospermous Angelicinæ, the albumen being curved lengthwise.
		Smyrniaceæ.	Campylospermous Angelicinæ, the alb. being curved inwards at its sides.
		Angelicaceæ.	Orthospermous Ang., the alb. being flat or nearly so.
	LORANTHINÆ.	*Loranthaceæ.*	Stamens equal to and opposite the petals, which are occasionally connate.

Suborders.	Sections and subsections.	Types and subtypes.	
SYRINGALES. ERICOSÆ.	STYRACINÆ. Trees or shrubs, with alt. simp. leaves, stip. 0, fl. reg., frt. indehiscent, seeds def. or solitary, placentæ central, rad. hilose.	*Ebenaceæ.*	Non-lactescent, fl. reg. and separated, stam. def., seeds few and pendulous. [with large scars.
		Sapotaceæ.	Lactescent, fl. reg. and united, seeds many and erect,
		Belvisiaceæ.	Cor. plicate, calyx persistent, frt. baccate, seeds indef.
		Styraceæ.	Anth. innate and introrse, ovules in pairs ascending and descending, seeds mostly sol. and albuminous.
	ERICINÆ. Fl. mostly reg., and cor. imbric., stam. equal pet. in number and alt., or twice as many, anthers usually 2-celled and distinct at base or apex, pl. central, seeds many.	*Epacridaceæ.*	Fl. reg., subperig., bracteæ imbricated, anth. 1-celled, dry, and exappendiculate.
		Ericaceæ.	Germ. free, 2-celled, anth. dry, appendiculate, albumen fleshy, emb. axile. [straight, testa adherent.
		Ericidæ.	Shrubby or arboresct., anth. always appendiculate, style
		Pyrolidæ.	Herbaceous, style declinate, seeds winged, testa loose and reticulated. [succulent.
		Vacciniaceæ.	Cor. and stam. epig., anth. 2-celled, 2-horned, fruit
	CAMPANULINÆ. Calyx in general adnate, corolliferous and staminiferous, stam. alt. with the petals and equal to them in number, or fewer, plac. central and polyspermous.	*Campanulaceæ.*	Lactesct., cor. valvate, stam. not gynandrous, style pilose but not indusiate. [pollen oval.
		Lobelidæ.	Cor. irreg., pet. sometimes discrete, anth. syngenesious,
		Campanulidæ.	Cor. regular, stam. discrete, pollen round.
		Stylidiaceæ.	Fl. gynandrous, cor. irreg., seeds indef., albumin.
		Goodeniaceæ.	Non-lactescent, cor. irreg. or subreg., lobes induplic., stig. indusiate.
		Goodenovidæ.	Frt. a capsule, 2-4-celled, seeds indef. and albuminous.
		Scævolidæ.	Frt. drupaceous or nut-like, inf., seeds 1-2, alb. fleshy.
		Brunonidæ.	Inf. capitate, fl. nearly reg., frt. a utricle enclosed by indurated calyx, seed 1, alb. 0.
ASTEROSÆ.	ASTERINÆ. Inf. capitate, cor. valvate, anth. syngenesious, rarely free, lvs. opp. or alt., stip. 0. — *ASTERIANÆ.* Stam. syngen., rarely free, seeds erect, alb. 0, or very spare.	*Cichoraceæ.*	Fl. all ligulate or unilabiate, and united, sap mostly lactescent.
		Mutisiaceæ.	Fl. bilabiate, recept. naked, lvs. sometimes cirrhiferous,
		Cynaraceæ.	Fl. all tubular, recept. chaffy, often fleshy, style nodose and hairy. [not fleshy, style not tumid.
		Asteraceæ.	Fl. tubular in disk, mostly ligulate in radius, recept.
	CALYCERIANÆ.	*Calyceraceæ.*	Herbs with capitate inf., semi-connate anth., and pend. seeds with fleshy albumen.
	VALERINÆ. Cor. imbric. and staminif., fil. and anthers discrete, ovar. 1-3-celled, seed 1, pend., rad. supr.	*Dipsaceæ.*	Inf. capit., stam. induplic., germ. 1-celled, seeds alb.
		Valerianaceæ.	Inf. cymose or corymbiform, calyx strictly adnate, germ. 3-celled, frt. 1-celled, albumen 0.
	RUBIACINÆ. Stems nodoso-articulated, stam. discrete and alt., carp. 2-3, connate, ovules 1 or many, radicle mostly near the hilum.	*Rubiaceæ.*	Lvs. stellate, stip. 0, or indistinguishable from leaves, seed 1, erect. [alb. fleshy or horny.
		Cinchonaceæ.	Lvs. opposite, entire, stip. intrafoliaceous, carp. 2,
		Caprifoliaceæ.	Lvs. opp., exstip., or substip., carp. 2-4, seeds pend., emb. straight, alb. fleshy.
		Loniceridæ.	Cor. mostly irreg., style filiform, lvs. entire and exstip.
		Sambucidæ.	Cor. regular, stig. 3, sessile, leaves serrate and substip.
RHÆADOSÆ (continued). THALAMIFLORÆ or *Hypogynous Apopetalous Dicotyledons.*	VITINÆ. Petals valvate, broad at base, occasionally concrete, stam. def., often 1-adelphous, germ. undivided, placentæ central.	*Leeaceæ.*	Excirrhose, synpet., stam. alt. with petals, germ. 3-6-celled, emb. bowed. [germ. 2-celled, emb. erect.
		Viteaceæ.	Sarmentose often cirrhose, apopet., stam. opp. petals,
		Meliaceæ.	Excirrhose non-scandent, stam. double the pet. in number, often 1-adelph., emb. inverted.
		Humiridæ.	Pet. quincuncial, st. simply 1-adelph., connectiv. dilated.
		Melidæ.	Fil. form an antherif. tube, pet. valv., connectiv. undil.
		Cedrelidæ.	Stam. 1 adelph., rarely free, seeds many, and winged.
	CISTINÆ. Leaves dotted or dotless, sep. imbric., germ. symmet., carp. connate, pla. parietal or subpar., rarely central. — *HYPERICIANÆ.* Leaves mostly dotted, placentæ axial or subcentral, seeds exarillate.	*Garciniaceæ.*	Resinous, sep. irreg., stam. many and unequal, anth. adnate and linear.
		Hypericaceæ.	Res. or glandiferous, st. many, fil. connate, anthers versatile.
		Frankeniaceæ.	Non-resinous, stam. definite, anth. dehiscent by chinks.
	CISTIANÆ. Leaves mostly dotless, plac. parietal, rarely axial, seeds mostly arillate or appendiculate.	*Violaceæ.*	Stipulate, pet. 5, discrete, stam. def., fil. elongated beyond the anthers, style 1, pl. narrow.
		Violidæ.	Sep. irreg. and biseriate, pet. unequal, fil. free, & dilat.
		Alsodidæ.	Pet. equal, stamens connected at base or exserted from a cup-like nectary. [straight, erect.
		Droseraceæ.	Circinnate, stam. def., styles distinct or nearly so, emb.
		Cistaceæ.	Impunctate leaves, æstiv. contorted, stam. indef., seeds exaril., alb. mealy, emb. inverted.
		Bixaceæ.	Leaves glabrous or punctate, st. indef., style 1, seeds arillate or pulpose, emb. erect. [emb. straight.
		Flacourtiaceæ.	Lvs. exstip., cor. a- or apo- pet., placentæ branched,
		Marcgraviaceæ.	Lvs. exstip., cor. syn- or apo- pet., st. indef., pl. axial, seeds indef., minute, pulpose. [and comose.
		Tamaricaceæ.	Lvs. exstip., stam. def., pl. parieto-basal, seeds exalb.
	DIANTHINÆ. Leaves opp., entire, exstip., sepal and pet. imb., pl. central, seeds numerous, alb. mostly present and mealy.	*Elatinaceæ.*	Stigmata capitate, seeds exalb., emb. straight.
		Dianthaceæ.	Stigmata simple filiform, alb. mealy, emb. curved.
		Silenidæ.	Sep. connate forming a tube, torus columnar, discrete, germ. 1 or more celled. [columnar, germ. 1-celled.
		Alsinidæ.	Calyx not tubular, torus adherent to calyx and not
	GERANINÆ OR *GRUINÆ.* Lvs. impunctate, sep. imbric., pet. imbric. or contorted, stam. def., carp. aggregate or connate, pl. axial, seeds definite.	*Linaceæ.*	Lvs. exstip., fl. symmet., st. submonadelph., carpels connate, stig. capitate, seeds pend., sub-solitary.
		Oxalidaceæ.	Lvs. compd., fl. symmet., st. free or slightly connate, carp. connate, seeds arill. and album.
		Balsaminaceæ.	Lvs. simp., exstip., fl. unsym., cal. spurred, seeds many, pend. and exalb. [nate, frt. drup., seed 1 and exalb.
		Hydrocereæ.	Lvs. exstip., cal. calcarate, st. def., anth. slightly con-
		Tropæolaceæ.	Lvs. simp. and exstip., fl. irreg. and calcar., st. def., discrete, frt. cap., seed 1, and exalb.
		Geraniaceæ.	Lvs. stip., fl. symmet., carp. adherent to a woody axis, 2-ovuled, 1-seeded, exaril. exalb.
	MALVINÆ. Lvs. simp. & alt., æstiv. imb., valvate or contorted, carp. several, & either with central pl. or round an axis. — *MALVIANÆ.* Sep. valv., pet. contorted, stam. def. or indef., carp. free or connate, lvs. stipul.	*Malvaceæ.*	Calyx persist., st. monadelph., anth. 1-celled, dehis. transversely, pubescence stellate.
		Malvidæ.	Sep. exactly valvate, staminif., tube uncleft.
		Bombacidæ.	Sep. subvalv. (pet. sometimes 0), staminif. tube 5-cleft.
		Bromaceæ.	Stam. monadelph., anth. 2-celled, dehisc. lengthwise, pubesc. often stellate. [nate, seeds 2, many or 1.
		Tiliaceæ.	Stip. decid., sep. connate or decid., st. free or subcon-
		Tilidæ.	Sep. and stam. free, anth. dehiscent by chinks, seeds many and alb.
		Elæocarpidæ.	————————, pet. lobed or fringed, anth. dehisc. by pores, seeds many and alb.
		Dipterocarpidæ.	Cal. tubular, anth. dehisc. by pores, seed 1, exalb.
	CAMELLIANÆ. Sep. and pet. imbric., stam. indef., carpels connate, stipules 0.	*Chlenaceæ.*	Sep. 3, stam. 1-adelph., seeds suspended and alb., emb. green.
		Theaceæ.	Exstip. subinvolucrate, sep. 5 or more, stam. mon- or poly- adelph., alb. 0, or spare.

Class.	Orders.	Sections.	Types and subtypes.	
SELANTHI, OR CYTINARES.	CYTINALES.		*Rafflesiaceæ.*	Globose, many-sepaled, anth. dehist. by terminal pores.
			Cytinaceæ.	Subcaulescent, few sepaled, anth. dehisct. lengthwise by chinks.
	CYNOMORIALES.		*Cynomoriaceæ.*	Perianth abortive or 1-sepaled, stamen solitary.
			Balanophoraceæ.	Perianth 3-sepaled in stamineous fl., stam. several and connate.
SYRINGALES.	PRIMULOSÆ (4364-5), or *Hypocorollous sympetalous Exogenæ.*	PLANTAGINÆ. Non-lactescent herbs or undershrubs, leaves simple, exstip., infl. aggregate, cal. persistent, germen free, 1-celled, embryo straight and axile.	*Globulariaceæ.*	Infl. capitate, fl. mostly irreg., stam. alt. with petals often didyn., seed pend., alb. fleshy.
			Armeriaceæ.	Fl. reg., syn- or apo- pet., cal. 5-plicate, st. straight, opp. pet., alb. mealy.
			Staticidæ.	Cor. pentapetalous, styles distinct, frt. irreg. dehisct.
			Plumbaginidæ.	Cor. synpet., styles connate, frt. subcapsular.
			Plantaginaceæ.	Cor. reg., scarious, indup., stam. 4, alt. with lobes of cor., fr. pyxidium.
		PRIMULINÆ. Leaves opposite, exstip., simple (rarely pinnate), infl. non-congested, flowers regular, but unsymmetrical and aqueous juices.	*Primulaceæ.*	Stam. more than 2 and opp. pet., or alt. with sepals, frt. 1-celled, pl. free and central.
			Primulidæ.	Herbs. with cap. frt., rarely becoming slightly fleshy, seeds alb., radicle transverse.
			Myrsinidæ.	Trees or shrubs, frt. fleshy and indehist, ovules immersed in a fleshy placenta.
			Oleaceæ.	Stam. 2, fl. syn- apo- or a- petalous, carp. 2, connate, frt. 1-2-celled.
			Fraxinidæ.	Cal. free, cor. valvate, stig. simp. or bifid, seeds 1-2, pend., alb. fleshy, abundant.
			Jasminidæ.	Cal. free, cor. contorto-imbric., stig. 2-lobed, seed sol., erect, alb. little or none.
			Columellidæ.	Cal. adherent, cor. convolute, stig. capitate, seeds many alb. fleshy.
		GENTIANINÆ. Carpels 2 and accumbent, stam. alternate with petals, which are contorted, rarely valvate, leaves mostly opposite and simple, juices often milky.	*Loganiaceæ.*	Non-lactescent, lvs. opp., mostly stip., cor. convolute, pollen powdery, seeds peltate and albumin.
			Loganidæ.	Cor. simply convolute, pollen 3-ribbed, testa reticulate, emb. erect.
			Potalidæ.	Cor. contorto-convol., pollen simple and elliptical, pl. 4-lobed, emb. inverted.
			Strychnaceæ.	Lactescent, stip. 0, cor. contorted, imbric. or imbricato-contorted, emb. foliaceous.
			Stapelidæ.	Cor. imbric. or imbricato-contorted, fl. gynandrous, pollen waxy, stig. dilated.
			Apocynidæ.	Cor. contorted, stam. discrete, pollen powdery, stigma simple.
			Gentianaceæ.	Non-lact., cor marcescent, pollen 3-nate, seeds several or many, alb. fleshy.
			Spigelidæ.	Lvs. opp., simp. stip. or substip., cor. valv., style articulated.
			Gentianidæ.	Lvs. opp., simp., exstip., cor. contorto-imbricate, style continuous.
			Menyanthidæ.	Lvs. alt., exstip., simp. or comp., cor. contorto-imbric., frt. dry and capsular.
		SOLANINÆ. Flowers symmet., mostly regular, corolla 5-lobed, often plicate, ovary 2-4, distinct or connate, leaves in general alternate.	*Boraginaceæ.*	Lvs. rough, non-lactescent, mucilag. juices, flowers 5-ary, frt. 4-nary, seeds def., pendul., emb. inverted.
			Boraginidæ.	Ovarium deeply 4-lobed, style central and basal, seeds solitary and exalbuminous.
			Heliotropidæ.	Ovar. 2-4-celled, ovules few, style term. and continuous.
			Hydrophyllidæ.	Ovar. 1-celled or sub-bilocular, nect. 5, each 2-scaled, style term., alb. abundant.
			Hydroleaceæ.	Non-lactest., cor. imbric., germ. 2-3-celled, styles 2-3, discrete, seeds minute, indef., emb. straight, alb. fleshy.
			Convolvulaceæ.	Sub-lactest., cal. imbric., cor. plicato-contorted, ovar. 2-4-celled, ov. def. and erect.
			Cuscutidæ.	Stems leafless, embryo spiral and acotyledonous.
			Convolvulidæ.	Stems leafy, embryo curved, cotyled. 2 and corrugate.
			Polemoniaceæ.	Herb. non-lactest., fl. reg., 5-androus, pollen mostly blue, ger. 3-valved, 3-celled, pl. 3-sided, emb. straight.
			Solanaceæ.	Carp. incumb., frt. 2-celled, baccate or capsular, pl. central, ovules indef., emb. curved, and leaves alternate.
			Cestridæ.	Cor. reg., plicate, emb. straight, cotyled. foliaceous.
			Solanidæ.	Cor. mostly plicate, stam. equal to its lobes, emb. much curved.
			Nolanidæ.	Cor. reg. and plicate, stam. equal to pet. in numb., ovar. deeply lobed, emb. bowed.
			Verbascidæ.	Cor. non-plicate, sometimes irreg., stam. 5 and unequal, or didynam., emb. slightly curved.
		MENTHINÆ. Non-lactescent, leaves mostly simple, stipules 0, flowers irreg., often labiate, stam. def., often didynamous, carpels 4, or when 2 incumbent.	*Scrophulariaceæ.*	Herb. seldom suffruticose, fl. mostly irreg. and unsym., carp. 2, incumb., seeds many, and albuminous.
			Scrophularidæ.	Bracteæ simple, stigma 2-lobed, radicle hilose.
			Rhinanthidæ.	Bracteæ crested, stigma obtuse, radicle abhilose.
			Utriculariaceæ.	Aquatic herbs, fl. irreg., stam. 2, fertile, 0 barren, cap. 1-celled, seeds many.
			Menthaceæ or *Labiatæ.*	Stems or branches square, lvs. opp., infl. verticillastrous. Fl. irreg. and unsym., stam. didynam., ovar. 4-lobed, seeds solitary and erect.
			Verbenaceæ.	Fl. irreg. and unsym., cor. sub-labiate, stam. didynam., disk 0, frt. 2-4-celled, seeds def. and wingless.
			Verbenidæ.	Bracteæ sol., frt. 2-4-celled, seed 1, rad. inferior.
			Myoporidæ.	Fl. ebracteate, lvs. simp. and petiolate, frt. 2-4-celled, cells 1-2-seeded, seeds pend., rad. superior.
			Selâginidæ.	Lvs. simp., sessile, fl. unibracteate, frt. 2-celled, seed 1, pend., rad. superior.
			Bignoniaceæ.	Trees with mostly compd. lvs., fl. irreg. and unsym., seeds compressed and winged, alb. 0.
			Acanthaceæ.	Fl. irreg. and unsym., bracteæ large, frt. caps., seeds wingless, alb. 0.
			Sesamidæ.	Frt. 1-celled, dry and woody, placentæ ligneous, seeds def. or indef., testæ papery.
			Cyrtandridæ.	Frt. 1-2-celled, pl. bilamellate, seeds naked or comose.
			Acanthidæ.	Frt. capsular and 2-celled, dissepiments hooked.
			Orobanchaceæ.	Leafless parasites, fl. irreg. and unsym., anth. appendiculate, ovar. 1-celled, pl. lateral, seeds indef. and albumin., emb. inverted.
			Gesneriaceæ.	Cor. more or less irreg., stam. didyn., stig. capitate, pl. parietal and double, seeds indef. minute, and pedicelled, alb. fleshy emb. erect.
			Besleridæ.	Calyx free.
			Gesneridæ.	Calyx adherent to the germen.

SYNOPSIS

OF THE

CLASSES, ORDERS, AND MINOR SUBDIVISIONS

OF THE

VEGETABLE KINGDOM.

With their chief Associating and Differential Characters reduced to the Form of General Rules: the most important Exceptions being added, and the principal Synonymes prefixed.

PLANTÆ, VEGETABILIA:

PLANTS, VEGETABLES, OR VEGETALS.

(4953.) GEN. RULE. Organic living beings, endowed with irritability, but devoid of sense and voluntary motion. (2-8.)

(4954.) EXCEPTIONS. The *Oscillatoriæ* exhibit motions which are apparently spontaneous; but the propriety of their location amongst vegetables is questionable. Too little is known of the Zoocarpes to allow them to be admitted as exceptions. (181-29.)

(4955.) *Observations.* Plants are for the most part fixed and stationary, being attached either to the soil in which they grow, or to some other body, which, while it gives them support, deprives them of the privilege of locomotion. They are seldom free, for, although a few aquatics are unattached to solid matter, they float in water, which is their fitting soil; and their casual movements from place to place are the result of external and independent forces.

Vegetables have no common receptacle for food (or stomach); their chief organs of nutrition are external, those of imbibition and absorption being usually collected on the lower parts, and stretch downwards, forming roots; while the flowers and seeds, or other equivalent organs of reproduction, are mostly found upon the upper parts, as on the stem and branches. Hence, from this reversed scheme of organization, plants have been said by some naturalists to be *inverted* animals.

(4956.) NOTE. The vegetable reign or kingdom has been variously divided into regions or sub-kingdoms: the most important of these are founded on the modifications observable in the organs of vegetation and reproduction.

According to the reproductive system, plants have been distinguished into the flowering or seedbearing, and the flowerless or seedless groups; and, according to the nutritive system, they have been distinguished into the cellular or homogeneous, and the vascular, or, rather, the tubivascular series, which are heterogeneous.

These schemes, although differing in some cardinal points, have still many characters in common. Thus the flowerless or seedless plants are almost universally cellular, and the flowering or seedbearing ones as constantly tubivascular.

The ferns form the chief exception to this rule, for, although flowerless, they are tubivascular; and their heterogeneous unstratified stems, as well as their general port and habit, associate them intimately with one part of the flowering tubivascular series; for the unstratified tubivascular plants, if allied to the stratified ones by their heterogeneous structure, are also connected to the cellular ones by their want of stratification, as well as by their partial destitution of flowers. Hence an intermediate region is distinguishable, in which both the organs of nutrition and reproduction are considered as affording differential characters: and the scheme thus assumes a ternary instead of a binary disposition.

Although some of the more obvious natural associations, such as Fungi, Mosses, Ferns, and Grasses, Rushes, Thistle-like and Umbel-flowering plants, were early recognized, and almost universally admitted, and although such associations were extended and multiplied by several systematic botanists, especially by Lobel and Pena, yet it was not until the time of Ray that these isolated and often ill assorted groups were reduced to any general scheme, or the arrangement of vegetables according to their natural affinities attempted. The plans

of Cæsalpinus and Morison are rather artificial than natural in their construction; and it is to the Methodus Emendata of Ray, published in 1703, that the rise of the present natural system must be traced. Upon it the systems both of Linnæus and Jussieu were founded; and, notwithstanding the numerous alterations made in the details, its general principles were adopted by both, and indeed have been almost invariably followed in spirit, however terms may have been altered, to the present time.

(4957.) Ray divided vegetables into two great classes, the FLOWERLESS and the FLOWERING; the latter being again immediately divided into the DI- and MONOCOTYLEDONS. The *Flowerless* plants of Ray are equivalent to the *Cryptogamic* or *Acotyledonous* series of Linnæus and Jussieu, and to the Cellulares of most modern writers; De Candolle, however, excludes the Ferns. And the *Flowering* plants of Ray are equivalent to the Phænogamic or Cotyledonous series of the present day, and to the *Vasculares* of De Candolle. Furthermore, the Mono- and Di- Cotyledons of Ray are identical with those of Linnæus and Jussieu; and, excepting the Ferns, with the *Endogenæ* and Exogenæ of De Candolle.

Vegetables may therefore be primarily divided either, according to Ray, into the Flowerless and Flowering series, the latter being immediately divisible in Di- and Monocotyledons, or, according to Linnæus and Jussieu, into A- Mono- and Di- cotyledons, as the primary divisions. Or, according to De Candolle, into *Cellulares* and *Vasculares*, the latter being distinguished into *Endogenæ* and *Exogenæ*. Or into the *Cryptogamic* and *Phænogamic*, the *Sexual* and *Exexual*, the *Embryonate* and *Exembryonate* groups of various authors, which are but other names for the primary classes of Ray; or, as in the preceding Outlines, into the *Myc-affines*, *Term-affines*, and *Cresc-affines*, which names have been proposed to obviate the objections common to terms including a definition.

REGION I.

MYCAFFINES: *MOSS ALLIES.*

(4958.) *SYN.* PLANTÆ CELLULARES. *De Cand.* ACOTYLEDONEÆ and PSEUDOCOTYLEDONEÆ, *Agardh.* ARHIZÆ, *Richard.* SYNGENÆ, *Fries.* TELOGENÆ, *Burn.* ACROGENÆ, *Lind.* PART of ACOTYLEDONES and CRYPTOGAMÆ, *Juss.* and *Linn.* HOMONEMEA and HETERONEMEA, *Bartl.* PLANTÆ FLORE DESTITUTÆ, *Ray.*

(4959.) GEN. RULE. Cellular, flowerless, seedless plants, propagated by spores, sporidia, or frustules.

(4960.) *Obs.* The cellular structure of these plants is variable in form, but always destitute of tubular vessels. Their tegument differs from true cuticle, in being scarcely distinguishable from the cellular substance it encloses, and in being destitute of stomata, except in *Marchantia* and *Targiona* of the Liverworts. Their leaves, when present, are without a *pleurophyl* or skeleton, and their stems, even when apparently endogenous, are unstratified and homogeneous. When the organs assume a definite number, their disposition is binary or quaternary.

CLASS I. ALGÆ OR ALGARES: *FLAGS.*

(4961.) *SYN.* ALGÆ et LICHENES, *Auct.* ALGÆ, *Linn.* and *Juss.* Part of PLANTÆ FLORE DESTITUTÆ AQUIS IMMERSÆ, *Ray.* *Phycei, Ach.* and CONFERVÆ, *Dillw.* THALASSIOPHYTA, *Lamour.* HYDROPHYTA, *Lyngb.* LICHENES, HYDROPHYCÆ, *Fries.*

(4962.) GEN. RULE. Foliaceous Mycaffines, or agamic cellular plants, with the thallus always present, and for the most part leaf-like, but without any distinct axis.

(4963.) *Obs.* The thallus is sometimes very minute, as in *Endocarpon athallum* of the Lichens; and sometimes scarcely foliaceous, as in the Byssine Lichens, which are intimately connected with the Fungi.

CLASS II. FUNGI OR FUNGARES: *MUSHROOMS, &c.*

(4964.) *SYN.* FUNGI, *Ray, Lin. Juss.* FUNGI, GASTEROMYCI, &c. *Grev.* EPIPHYTÆ, *Link.* HYMENOMYCETES, GASTEROMYCETES, PYRENOMYCETES, and CONIOMYCETES, *Fries, Bartl,* &c.

GEN. RULE. Aphyllous Mycaffines, or leafless, flowerless, cellular plants, for the most part very fugacious.

(4965.) *Obs.* The fungi contain a large proportion of azote in their chemical composition; hence the animal odour they possess, and the fetor they exhale when decaying. Some of the higher fungi develop an axis or regular stem; and the lower ones, which the most resemble the subfoliaceous Lichens, are distinguishable in the obscure tribes by the presence of fruit or spores, and the subordination or even absence of the thallus, which is essential to the Algæ.

CLASS III. MUSCI OR MUSCARES: *MOSSES*, &c.

(4966.) *SYN.* Musci, *Vet. Auct.* Part of Musci, *Ray.* Musci et Hepaticæ, *Linn.* and *Juss.* Cellulares Foliaceæ, *De Cand.* Pseudo-cotyledoneæ, *Agardh.* Muscoideæ, *Agardh.*, *Lind.*, &c. Cryptogamæ, Cellulares, *Nees Von Esenbeck*, &c.

(4967.) GEN. RULE. Cellular, flowerless, seedless plants, with a distinct axis, and processes either in the form of leaves or branches; the spores invested with a proper integument, and contained in urns, which are for the most part terminal or axillary, rarely imbedded, and then superficial.

(4968.) *Obs.* Although the axis is one of the most constant characters of this class, it is scarcely developed in some of the Liverworts; but when thus obscure, the green leafy structure and urns or thecæ, form sufficient diagnostic signs; and, when the leaves are absent, as in the Charas, the distinct axis, whorled branches, and axillary fruit, forbid all doubt.

REGION II.

TERMAFFINES, OR *GRASS-ALLIES.*

(4969.) *SYN.* Vasculares Endogenæ, *De Cand.* Monocotyledones, and part of Acotyledones, *Ray*, *Linn.*, and *Juss.* Endorhizeæ, *Rich.* Crypto-cotyledoneæ or Graniferæ, and Pseudo-cotyledoneæ, *Agardh.* Endogenæ and Filicoideæ. *Lind.*

GEN. RULE. Tubivascular, unstratified, endogenous plants.

(4970.) *Obs.* The tegument of these plants is a true cuticle, formed of condensed cellular structure, and bearing stomata. The tubular vessels are variable; in general, both spiral tubes and simple ducts are present: in the Ferns the former are less abundant than in the other orders; in some cases the spiral vessels are absent, or at least have not been observed; and perhaps even the common ducts may be occasionally obsolete, as in the Lemnaceæ, Salviniaceæ, &c.

CLASS IV. FILICES OR FILICARES: *FERNS, &c.*

(4971.) *SYN.* Filices vel Herbæ Capillares, et Capillaribus Affines, et pars Muscorum, *Ray.* Filices, *Lin.* and *Juss.* Endogenæ Cryptogamæ, *De Cand.* Part of Pseudo-cotyledoneæ, *Agardh.*

GEN. RULE. Cryptogamic Termaffines, or flowerless tubivascular plants, the stems being endogenous, heterogeneous, and unstratified, the branches vel foliage furnished with a ligneous skeleton, the venation variable, chiefly dichotonous, and the cuticle provided with stomata.

(4972.) Exceptions. Tubular vessels have not hitherto been observed in the Salviniaceæ, nor in Pilularia of the Marsiliaceæ; but stomata are present.

Obs. Ferns are generally considered as branchless plants, the main trunk of the arborescent species being called the *stipes*, and its leaflike processes or *fronds* denominated leaves; the stalk of each frond in the herbaceous species is likewise often, but improperly termed *stipes* also; whereas the true stipes or stem is either subterranean or abortive. The fronds are therefore neither leaves nor stems, but branches, the divisions of which are for the most part, but not always, foliaceous; and, instead of the *leaves* being truly dorsiferous, the fruit is borne on its own proper peduncles, which are however, in general, expanded and foliaceous. The above observation refers to the *Filices veræ* or *Pteridales* alone. In one of the other orders the branches are wholly leafless; and in the other, normal leaves are developed, and the fruit is axillary.

CLASS V. GRAMINA OR GRAMINARES: *GRASSES and Grassy Plants.*

(4973.) *SYN.* FRUMENTA, GRAMINA, et GRAMINIFOLIÆ, *Ray*. GRAMINA et CALAMARIÆ, *Lin.* GRAMINEÆ et CYPEROIDÆ, *Juss.* Part of ENDOGENÆ PHANEROGAMÆ, or MONOCOTYLEDONEÆ, *De Cand.* ENDOGENÆ GLUMACEÆ, *Lind.* Part of CRYPTOCOLYDONEÆ, *Agardh.* ENDORHIZEÆ GLUMACEÆ, *Rich.*

(4974.) GEN. RULE. Glumose flowering Termaffines, or monocotyledonous endogenæ, with flowers invested by glumes or setæ, and the venation of the foliage linear.

EXCEPTIONS. Sometimes two seed-lobes or cotyledons occur, as in wheat, but then they are alternate, not opposite to each other, and the secondary one is small.

(4975.) *Obs.* In the herbaceous grasses and sedges, the true stem is in general subterranean, and either creeping to a great extent, sending up branches or culms at intervals, or contracted, and forming a tuft, which has much similitude to a bulb. The true culm is therefore like the frond, rather to be considered a branch than a stem.

CLASS VI. PALMARES: *PALMS, and their Allies.*

(4976.) *SYN.* ARBORES ARUNDINACEÆ, HERBÆ BULBOSÆ et BULBOSIS AFFINES, *Ray.* PALMÆ et LILIA, *Lin.* Part of MONOCOTYLEDONES, *Juss.* Part of ENDORHIZEÆ, *Richard.* ENDOGENÆ PETALOIDEÆ, *De Cand.*, &c. Part of ENDOGENÆ CRYPTOCOTYLEDONEÆ, *Agardh.*

(4977.) GEN. RULE. Non-glumose flowering Termaffines; or monocotyledonous endogenæ, with the flowers either naked or invested by a distinct perianth, which is often petaloid.

(4978.) EXCEPTIONS. In some plants, as in Lemna, tubular vessels have not been observed; and in others, as some of the Aroideæ, the points of germination are indeterminate.

(4979.) *Obs.* The stems of the Palmares are in general unbranched, only a single bud being usually developed. They are either abortive, as in the bulbiferous species, or columnar, as in the Palms. Two or more buds are however sometimes developed, as in the garlic, and the stem becomes occasionally branched, as in the rhizoma of the iris, the asparagus, the doum palm, &c. The venation of the leaves is also for the most part simply linear; but in the Smilaceæ, Dioscoreaceæ, and Callaceæ, it is retiform: the leaves likewise, which are almost universally without articulation, are distinctly articulated with the stem, in many of the Orchidinæ.

REGION III.

CRESCAFFINES: *CRESS-ALLIES.*

(4980.) *SYN.* DICOTYLEDONES, *Ray, Lin.* and *Juss.* EXORHIZEÆ and SYNORHIZEÆ, *Rich.* EXOGENÆ or DICOTYLEDONEÆ, *De Cand.*, &c. PHANEROCOTYLEDONEÆ or SEMINIFERÆ, *Agardh.* VEG. DICOTYLEDONEA GYMNOBLASTA, and part of CHALMYDOBLASTA, *Bart.*

(4984.) GEN. RULE. Exogenous, stratified, tubivascular (rarely subcellular) flowering plants.

(4982.) *Obs.* The cotyledons are two or more, verticillate, very seldom absent. The radicle naked, and the parts of the flower have in general a quinary disposition. Bark wood and pith are almost without exception distinctly stratified; in perennial species the newer layers being deposited without the older wood, and within the older bark. The form of the stem is in general conical, and branched; rarely, as in Papaya, cylindrical and unbranched.

(4983.) EXCEPTIONS. Sometimes the strata are indistinct; occasionally the tubular vessels are few, or almost absent; not unfrequently the seed-lobes are conferruminate, or undistinguishable from each other; and examples are not wanting, although rare, in which they are altogether obsolete.

CLASS VII. PINARES OR ZAPINI: *PINES and CYCASES.*

(4984.) *SYN.* ARBORES APETALÆ CONIFERÆ (part of) *Ray.* CONIFERÆ, *Juss.*, *De Candolle*, &c. SYNORHIZÆ, *Richard.* PHANEROGAMÆ GYMNOSPERMÆ, *Brongniart.*

(4985.) GEN. RULE. Tubivascular linearicostate gymnospermous Cresscaffines, or synorhizous exogenæ, with naked seeds, two or more cotyledons, linearicostate leaves, and glanduliferous wood.

CLASS VIII. ROSARES OR EUCARPÆ.

(4986.) *SYN.* HERBÆ et ARBORES, DICOTYLEDONEÆ (part of), *Ray.* DICOTYLEDONES vel PLANTÆ, *Lin.* DICOTYLEDONES, *Juss.* DICOTYLEDONEÆ vel EXOGENÆ, *De Cand.* (Excluding Pinares and Selanthi), EXOGENÆ ANGIOSPERMÆ, vel PHANEROGAMÆ DICOTYLEDONES, *Brongn.*

(4987.) GEN. RULE. Tubivascular, reticostate, angiospermous Crescaffines, or dicotyledonous exogenæ, with the ovules included in an ovarium, and the leaves with a reticulate costation.

(4988.) EXCEPTIONS. The leaves are occasionally absent; and, when their place is supplied by phyllodia, the costules in these dilated petioles are often more or less parallel. The stems also are sometimes not conical and branched, but simple and branchless, as in *Papaya.*

(4988.) *Obs.* Besides the conferruminate cotyledons of the Hippocastanidæ, and some Myrtaceæ, which form a pseudo-monocotyledonous embryo, the seed-lobes are undistinguishable in *Penæa*, and absent in Cuscuta. The Peppers, although decidedly exogenous plants, are said to have only a single cotyledon to their seeds, and it has been questioned, but perhaps without sufficient reason, whether the Nymphæaceæ are truly dicotyledons.

CLASS IX. CYTINARES OR SELANTHI: *SELWORTS.*

(4989.) *SYN.* RHIZANTHEÆ, *Blume.* CYTINEÆ, *Brong.* BALANOPHOREÆ, *Rich.* Part of ARISTOLOCHIÆ, *Lind.* CYNOMORIÆ, part of URTICEÆ, *Agardh.*

(4990.) GEN. RULE. Subcellular, leafless, flowering Crescaffines, with a fungoid port, and parasitic habit.

(4991.) *Obs.* These plants, which have in part been arranged with the Exogenæ, and part with the Endogenæ, and sometimes even with the Cryptogamic tribes, would seem to have been exceptions and anomalies in every group with which they were associated. Their segregation was therefore desirable.

ORDERS.

CYTINALES.

(4992.) *SYN.* CYTINEÆ, *Brong.* RHIZANTHEÆ, *Blume.*

GEN. RULE. Dicotyledonous selanthi, or subcellular, leafless, flowering fungoid parasites, with parietal placentæ, indefinite ovules, a divided embryo, straight ovule, and the embryo included within the albumen. (4901.)

(4993.) *Obs.* The parts of the embryo are often scarcely distinguishable; and the spiral vessels are very few in these plants.

(4994.) *RAFFLESIACEÆ.* RHZANTHEÆ, *Blume.* Part of CYTINEÆ, *Auct.*

GEN. RULE. Ib. The plant being globose, many-sepaled, and the anthers dehiscent by terminal pores. (4914-17.)

(4995.) *CYTINACEÆ.* Part of CYTINEÆ, or ARISTOLOCHIÆ, *Auct.*

GEN. RULE. Ib. The plant subcaulescent, few-sepaled, and the anthers dehiscent by longitudinal chinks. (4915-16.)

CYNOMORIALES.

(4996.) *SYN.* BALANOPHOREÆ, *Rich.* CYNOMORIACEÆ, *Agardh.*

GEN. RULE. Monocotyledonous selanthi, or subcellular leafless flowering fungoid parasites, with spadiciform inflorescence, a 1-celled ovary, solitary pendulous ovule, and an undivided embryo lodged in a superficial excavation of the albumen. (4902-3.)

(4997.) *CYNOMORIACEÆ.* Part of Cynomoriæ, *Agardh.* D°. of Balanophoreæ, *Rich.*

GEN. RULE. Ib. The perianth being abortive or 1-sepaled, and the flowers monandrous. (4906.)

(4998.) *BALANOPHORACEÆ.* Part of Balanophoreæ, *Richard.* Do. Cynomoriæ, *Agardh.*

(4999.) GEN. RULE. Ib. The sepals being three in the stamineous flowers, although abridged or abortive in the pistilline ones ; and the stamens several and connate. (4907.)

SYRINGALES.

(5000.) *SYN.* Dicotyledones, Monopetalæ, or Gamopetalæ, *Juss.* and *Rich.* Exogenæ Monopetalæ, *De Cand.* Herbæ et Arbores Monopetalæ, *Ray.*

(5001.) GEN. RULE. Angiospermous dicotyledons or exogenæ, with dichlamydeous synpetalous flowers. (4107.)

(5002.) Exceptions. In the *Staticidæ*, some of the *Lobelidæ*, and in *Ornus*, the petals are discrete ; in *Fraxinus* and *Glaux* the corolla is absent. Synpetalous plants also occasionally are met with among the Rosales. *q.v.*

PRIMULOSÆ.

(5003.) *SYN.* CLASS. VIII. *Juss.* Hypocorolleæ, *Richard.*

GEN. RULE. Hypocorollous syringales, or synpetalous, dichlamydeous, angiospermous exogenæ, with hypogynous corollæ. (4365-4111.)

(5004.) Exceptions. The petals are occasionally discrete, as in the *Staticidæ* and *Lobelidæ*, and also in Embesa of the Myrsinidæ, as well as in *Ornus* of the *Oleaceæ.* Sometimes, but rarely, the corolla is abortive, as in *Fraxinus* and *Glaux.* The calyx is adherent to the germen in the *Columellidæ*, the *Gesneridæ*, and *Mæsa* of the *Myrsinidæ*, and half adherent in *Samolus.*

PLANTAGINÆ.

(5005.) *SYN.* Part of Aggregatæ and Plantæ Dubii Ordinis, *Lin.* Part of Aggregatæ, *Bartl.* Plantagines and Nyctagines, *Juss.* Part of Tetrapetalæ Anomalæ, *Ray.*

(5006.) GEN. RULE. Angiospermous, synpetalous dicotyledons, herbaceous or suffruticose, with simple exstipulate leaves, aggregate inflorescence, persistent calyx, free 1-celled germen, and straight axile embryo. (4672.)

(5007.) Exceptions. The flowers are apopetalous in the *Staticidæ*, and the inflorescence is solitary in Littorella of the *Plantaginaceæ.*

(5008.) *GLOBULARIACEÆ.* Globulariæ, *De Cand.* Globularineæ, *Lind.*, &c. Aggregatæ, *Lin.*

GEN. RULE. Dichlamydeous, synpetalous dicotyledons, with capitate inflorescence, flowers mostly irregular, stamens alternate with the petals, and often didynamous; the germen free, 1-celled, and indehiscent ; the ovule solitary and pendulous, and the albumen fleshy. (4680-4.)

(5009.) *ARMERIACEÆ.* Plumbagineæ, *Vent.*, *Brown*, &c. Plumbagines, *Juss.*

GEN. RULE. Dichlamydeous, syn- or apo-petalous dicotyledons, with the inflorescence more or less aggregate, the flowers regular, stamens opposite the petals, the ovary free and 1-celled, the ovule solitary and suspended, and the embryo straight. (4676-7.)

(5010.) *STATICIDÆ.* Ib. Corolla apopetalous, and styles distinct. (4680.)

(5011.) *PLUMBAGINIDÆ.* Ib. Corolla synpetalous, styles connate. (4679.)

(5012.) *PLANTAGINACEÆ.* Plantagineæ, *Vent.*, *Brown*, &c. Plantagines, *Juss.* Pl. Dubii Ordinis, *Lin.* Tetrapetalæ Anomalæ, *Ray.*

GEN. RULE. Dichlamydeous, synpetalous dicotyledons, with the inflorescence spicate, the flowers regular, corolla scarious, stamens four, induplicate and alternate with the petals, filaments flaccid, germen free, and fruit a pyxidium. (4673-4.)

(5013.) Exception. The inflorescence is solitary in *Littorella.*

PRIMULINÆ.

(5014.) GEN. RULE. Synpetalous, dichlamydeous, angiospermous exogenæ, with aqueous juices, exstipulate, simple (rarely compound) leaves, inflorescence not congested, flowers regular but unsymmetrical, and the germen free. (4637.)

(5015.) Exceptions. Vide (5019-21-3). The leaves, which are mostly opposite, are sometimes crowded, and sometimes alternate.

(5016.) *PRIMULACEÆ.* Myrsineæ, *Bartl.* Lysimachiæ and Sapotis Aff., *Juss.* Preciæ and Sepiariæ, *Lin.*

GEN. RULE. Synpetalous, dichlamydeous, angiospermous exogenæ, with simple exstipulate leaves, noncongested inflorescence, regular unsymmetrical flowers, stamens more than two, and opposite the petals, or alternate with the sepals; germen superior, entire, 1-celled, the placenta free and central, the albumen fleshy, and the embryo transverse. (4660-1.)

(5017.) Exceptions. Vide (5019-21.)

(5018.) *PRIMULIDÆ.* Preciæ, *Lin.* Lysimachiæ, *Juss.* Primulaceæ, *Vent.*, &c.

GEN. RULE. Ib. Herbs, with capsular, dehiscent or rarely subdehiscent fruit. (4664.)

(5019.) Exceptions. *Glaux,* sometimes referred to the Plantaginaceæ, is apetalous; the germen is half inferior in *Samolus,* which, like part of the Myrsinidæ, has five supernumerary barren filaments. The fruit is slightly fleshy in *Trientalis.* In *Cyclamen* the embryo is destitute of cotyledons.

(5020.) *MYRSINIDÆ.* Sapotis Aff., *Juss.* Ophiospermeæ, *Vent.* Ardisiaceæ, *Juss.* and *Bartl.* Myrsineæ, *Brown.*

GEN. RULE. Ib. Trees or shrubs, with the fruit fleshy and indehiscent, and the ovules immersed in the fleshy placenta. (4663.)

(5021.) Exceptions. In *Mæsa* or *Bæobotrys* the calyx is adherent to the germen; in *Embesa* the petals are discrete; and in *Ægiceras* the albumen is absent; the locules of the anthers in this last-named genus are cellular.

(5022.) *OLEACEÆ.* Sepiariæ, *Lin.* Jasmineæ, *Juss.* Ligustrinæ, *Bart.*

GEN. RULE. Synpetalous, dichlamydeous, angiospermous exogenæ, with diandrous regular flowers, and a free 2-celled germen, becoming a 1-2-celled fruit. (4638-9.)

(5023.) Exceptions. The petals are free in *Ornus,* and absent in *Fraxinus.* In the *Columellidæ* the germen is inferior; but these latter plants are doubtfully referred to their present station.

(5024.) *FRAXINIDÆ.* Oleineæ, *Hoffmanseg* and *Link.* Lilaceæ, *Vent.* Oleaceæ, *Lind.*

GEN. RULE. Ib. The flowers occasionally a- or apo-petalous, the corolla when present valvate in æstivation, the fruit 1-2 seeded, the seeds pendulous, and the albumen fleshy and abundant. (4643.)

(5025.) Exceptions. Vide (5027).

(5026.) Ligustreæ. Ib. Leaves simple, fruit drupaceous or baccate. (4628.)

(5027.) Fraxineæ. Ib. Leaves compound, corolla 0 or apopetalous. Fruit a samara. (4647.)

(5028.) SYRINGEÆ. Ib. Leaves simple, fruit dry and capsular. (4646.)

(5029.) *JASMINIDÆ.* JASMINEÆ, *Jussieu*, *Brown*, &c.

GEN. RULE. Ib. Corolla contorto-imbricate in æstivation, the seeds solitary, erect, and with little or no albumen. (4642.)

(5030.) *Obs.* The ovules in the *Jasminidæ* are pendulous, and the seeds become erect from the unequal growth of the ovarium, the apex of which does not elongate.

(5031.) *COLUMELLIDÆ.* COLUMELLIÆ, *Don.* COLUMELLIACEÆ, *Lind.*

GEN. RULE. Synpetalous, dichlamydeous, angiospermous exogenæ, with an adherent calyx, the corolla convolute in æstivation, and bearing two stamens; the disk perigynous, the fruit capsular, 2-celled, and polyspermous, and the seeds with fleshy albumen.

GENTIANINÆ.

(5032.) CONTORTÆ, *Bartl.* ROTACEÆ and LURIDÆ (part of), *Lin.* GENTIANÆ and APOCINEÆ, *Juss.*

GEN. RULE. Hypocorollous, synpetalous, dichlamydeous exogenæ, with regular flowers, the stamens alternating with the petals, which are contorted (rarely valvate) in æstivation, the germen formed of two accumbent carpels, and many-ovuled; the leaves mostly opposite and simple, and the juices often milky.

(5033.) EXCEPTIONS. In the *Menyanthidæ* the leaves are alternate, and sometimes compound, as in *Menyanthes;* in the succulent *Apocynidæ* they are likewise subalternate. The æstivation of the corolla is valvate in *Gardneria* of the *Apocynidæ*, and in *Leptadenia* of the *Stapelidæ;* and in the *Loganidæ* it is simply convolute.

(5034.) *LOGANIACEÆ.* APOCYNEIS, RUBIACEIS, and GENTIANEIS AFFIN., *Auct.* LOGANIÆ, *Brown.* LOGANIACEÆ and POTALIACEÆ, *Lind.*

GEN. RULE. Hypocorollous, synpetalous, angiospermous exogenæ, with the stamens alternate with the petals, which are convolute in æstivation; the germen free, and formed of two accumbent carpels, the seeds peltate, the albumen cartilaginous or fleshy, and the embryo not foliaceous. The leaves are opposite, simple, entire, and usually with interpetiolar sheathing stipules, and the juices non-lactescent.

(5035.) EXCEPTIONS. The stipules are occasionally absent, as in some species of *Logania.*

(5036.) *LOGANIDÆ.* LOGANIEÆ, *Brown.* LOGANIACEÆ, *Lind.*

GEN. RULE. Ib. The æstivation of the corolla being simply convolute, the pollen 3-ribbed, the testa reticulate, and the embryo erect.

(5037.) EXCEPTIONS. Stipules sometimes absent in *Logania.*

(5038.) *POTALIDÆ.* POTALIEÆ, *Martius.* POTALIACEÆ, *Lind.*

GEN. RULE. Ib. The æstivation of the corolla being contorto-convolute, the pollen simple and elliptical, the placenta 4-lobed, and the embryo inverted.

(5039.) *STRYCHNACEÆ.* CONTORTÆ and LURIDÆ (part of), *Lin.* APOCINEÆ and APOC. AFF. (part of), *Juss.* ASCLEPIADEÆ, *Auct.*

GEN. RULE. Hypocorollous, synpetalous, angiospermous exogenæ, the stamens alternating with the petals, which are contorted or imbricato-contorted (rarely imbricate or valvate) in æstivation, and deciduous, the germen free, and formed of two accumbent carpels, one of which is sometimes abortive; the embryo is foliaceous, the leaves opposite, simple, and exstipulate, and the juices for the most part lactescent.

(5040.) The sap is not always milky, it is watery in the *Vincæ.* The æstivation of the corolla is valvate in Gardneria of the *Apocynidæ*, and in *Leptadenia* of the *Stapelidæ.*

(5041.) STAPELIDÆ.

GEN. RULE. Ib. The flowers being gynandrous, the pollen waxy, the stigma dilated and tabular.

EXCEPTIONS. The pollen is pulverulent in *Periploca, Hemidesmus, Gymnanthera,* and *Cryptostegia,* which are on this account distinguished as a subordinate group by Bartling, under the name of *Periploceæ,* the other genera in which the pollen is waxy being his genuine *Asclepiadeæ.*

(5042.) APOCYNIDÆ. Ib. The stamens being free, the pollen pulverulent, and the stigma simple.

(5043.) EXCEPTIONS. In the succulent species the leaves are subalternate, and in *Gardneria* the æstivation of the corolla is valvate. The albumen is variable, being in some genera, as *Apocynum, Nerium,* &c. very spare, and almost absent, while in others, as *Strychnos,* it is abundant.

(5044.) *GENTIANACEÆ.* ROTACEÆ (part of), *Lin.* GENTIANEÆ, *Juss.*, &c.

GEN. RULE. Hypocorollous, synpetalous, angiospermous exogenæ, the stamens alternating with the petals, which are contorted in æstivation, and marcescent (rarely deciduous,) the pollen ternate, the germen formed of two accumbent carpels, the ovules many, the albumen fleshy, the embryo straight, and not foliaceous. The leaves are mostly opposite and simple, and the juices bitter, but not lactescent.

(5045.) EXCEPTIONS. Vide *Menyanthidæ,* in which the leaves are alternate, and *Spigelidæ,* in which the corolla is valvate.

(5046.) *SPIGELIDÆ.* SPIGELIACEÆ, *Martius.*

GEN. RULE. Ib. The leaves being opposite, simple, stipulate, or substipulate, the corolla valvate in æstivation, the style articulated, and the seeds definite or subdefinite.

(5047.) *GENTIANIDÆ.* ROTACEÆ (part of), *Lin.* GENTIANEÆ (part of), *Juss.*

GEN. RULE. Ib. The leaves being opposite, simple, and exstipulate, the corolla contorto-imbricate in æstivation, the style continuous, and the seeds indefinite.

(5048.) MENYANTHIDÆ.

GEN. RULE. Ib. The leaves being exstipulate, alternate, and sometimes compound, the æstivation of the corolla contorto-imbricate, the style continuous, and the seeds indefinite.

SOLANINÆ.

(5049.) LURIDÆ, ASPERIFOLIÆ, and CAMPANACEÆ (part of), *Lin.* SOLANEÆ, BORAGINEÆ, and CONVOLVULI, *Juss.* TUBIFLORÆ, *Bartl.*

GEN. RULE. Hypocorollous, synpetalous, dichlamydeous exogenæ, with the flowers symmetrical, and mostly regular; the corolla 5-lobed, and often plicate in æstivation, the stamens five, and alternate with the lobes of the corolla, the ovaries 2-4, distinct or connate; the leaves in general alternate, and the sap rarely lactescent.

(5050.) EXCEPTIONS. In Verbascum, Echium, &c. the flowers are slightly irregular.

(5051.) *BORAGINACEÆ.* ASPERIFOLIÆ, *Ray, Lin.*, &c. BORAGINEÆ, *Juss.*, &c.

GEN. RULE. Hypocorollous exogenæ, with regular symmetrical quinary flowers, the stamens alternating with the petals, the fruit quaternary, seeds definite and pendulous, and the embryo inverted. The leaves are rough and alternate; the juices mucilaginous and non-lactescent, and the inflorescence often in scorpoid cymes.

(5052.) EXCEPTION. In *Echium* the corolla is slightly irregular.

(5053.) *BORAGINIDÆ.* BORAGINEÆ (part of), *Juss.*, &c. BORAGINEÆ, *Lind.*

GEN. RULE. Ib. The ovarium deeply 4-lobed. The style basal, the fruit a tetrakenium, seeds solitary and exalbuminous.

(5054.) EXCEPTIONS. *Echium* as above.

(5055.) *HELIOTROPIDÆ.* BORAGINEÆ (part of), *Juss.* HELIOTROPICEÆ, EHRETIACEÆ, and CORDIACEÆ, *Mart.*

GEN. RULE. Ib. The germen being 2-4 celled, undivided, the style terminal, and the ovules few.

(5056.) *Obs.* Albumen sometimes present, as in the Ehretiæ (4574), and the fruit is often succulent or subdrupaceous.

(5057.) *HYDROPHYLLIDÆ.* BORAGINEÆ (part of), *Juss.* HYDROPHYLLEÆ, *Von Mart.*

GEN. RULE. Ib. Ovarium 1-celled or sub-bilocular, style terminal, placenta parietal, seeds many, and albumen abundant. Nectaries five, each 2-scaled, and seated at the bases of the lobes of the corolla.

(5058.) *HYDROLEACEÆ.* DIAPENCIACEÆ § of CONVOLVULACEÆ, *Link.* HYDROLEÆ, *Brown.*

GEN. RULE. Hypocorollous exogenæ, with regular flowers, imbricate æstivation of the corolla, germen 2-3-celled, styles discrete, placentæ central, seeds minute and indefinite, albumen fleshy, embryo straight, the cotyledons flat, the leaves alternate, simple, and exstipulate, and the juices non-lactescent.

(5059.) *Obs.* The lobes of the corolla do not invariably agree with the number of divisions of the calyx. The stamens, however, are always equal to the sepals.

(5060.) *CONVOLVULACEÆ.* CAMPANACEÆ (part of), *Lin.* CONVOLVULI, *Juss.*

GEN. RULE. Hypocorollous exogenæ, with the calyx imbricate, and the corolla contorto-plicate in æstivation, a 2-4-celled germen, definite erect ovules, embryo curved or spiral, and cotyledons corrugate or wanting. The stems are usually twining, and the juices sublactescent.

(5061.) CONVOLVULIDÆ.

GEN. RULE. Ib. The stems being leafy, the cotyledons corrugate, and the embryo simply curved.

(5062.) *CUSCUTIDÆ.* CUSCUTINÆ, *Link.* CUSCUTEÆ, *Bartl.*

GEN. RULE. Ib. The stems being leafless, and the embryo spiral and acotyledonous.

(5063.) *POLEMONIACEÆ.* CAMPANACEÆ (part of), *Lin.* POLEMONIA, *Juss.* POLEMONIDEÆ, *De Cand.* and *Duby.*

GEN. RULE. Hypocorollous exogenæ, with regular pentandrous flowers, corolla 5-lobed and imbricate in æstivation, germen 3-valved, 3-celled, and placentæ 3-angled; the albumen horny, the embryo straight, and the cotyledons leafy.

(5064.) *Obs.* The pollen is mostly blue.

(5065.) POLEMONIDÆ.

GEN. RULE. Ib. The stems erect, not twining, leaves mostly opposite, inflorescence aggregate, stamens exserted from the middle of the tube of the corolla, and the dehiscence of the capsule loculicidal.

(5066.) *COBÆIDÆ.* COBÆACEÆ, *Don.*

GEN. RULE. Ib. The stem voluble, leaves alternate and pinnate, inflorescence solitary, stamens exserted from the base of the campanulate corolla, and the dehiscence of the capsule septicidal.

(5067.) *SOLANACEÆ.* BACCIFERÆ (part of), *Ray.* LURIDÆ, *Lin.* SOLANEÆ, *Juss.*

GEN. RULE. Hypocorollous exogenæ, with regular flowers, corolla mostly plicate in æstivation, germen formed of 2 incumbent carpels, the fruit 2-4-celled, placentæ central, and polyspermous; the seeds albuminous, the embryo curved, the leaves alternate, and the juices non-lactescent.

(5068.) Exceptions. In *Verbascum* the flowers are slightly irregular; and in other *Verbascidæ* the stamens are sometimes didynamous. In *Nolana* the ovarium is 5 or more lobed. In *Nicotiana multivalvis* the capsule is many-celled, and in *Cestrum* the embryo is straight.

(5069.) Cestridæ.

GEN. RULE. Ib. The embryo being straight, and the cotyledons foliaceous.

(5070.) Solanidæ.

GEN. RULE. Ib. The stamens being equal to the lobes of the corolla, which is usually plicate, and the embryo bowed.

(5071.) *Nicotiana multivalvis*, as above.

(5072.) Nolanidæ.

GEN. RULE. Ib. Stamens equal to the lobes of corolla, the æstivation of which is plicate, the ovarium deeply lobed, and the embryo much curved.

(5073.) Verbascidæ.

GEN. RULE. Ib. Corolla non-plicate, and sometimes subregular; the stamens five, and unequal, or even didynamous, and the embryo slightly curved.

MENTHINÆ.

(5074.) Verticillatæ, &c. *Ray*. Verticillatæ, Personatæ, &c., *Lin.* Labiatæ, Scrophulariæ, &c. *Juss.* Labiatifloræ, *Bartl.*

(5075.) GEN. RULE. Hypocorollous exogenæ (or Primulosæ), with non-lactescent juices, leaves mostly simple and exstipulate, flowers irregular (and often labiate), stamens definite and irregular (frequently didynamous), carpels four, or, when two, incumbent, and the embryo straight.

(5076.) Exceptions. In the *Gesneridæ* the calyx is adherent to the germen.

(5077.) *SCROPHULARIACEÆ.* Personatæ (part of), *Lin.* Scrophulariæ and Pediculares, *Juss.* Scrophularineæ, *Brown.* Personatæ, *De Cand.* Rhinanthoideæ and Personatæ, *Vent.* Antirrhineæ, *De Cand.* and *Duby.*

(5078.) GEN. RULE. Hypocorollous exogenæ, with non-lactescent herbaceous, seldom shrubby stems, opposite leaves, irregular unsymmetrical flowers, stamens 2-4, didynamous, germen formed of two incumbent carpels, fruit 2-celled, placentæ central and polyspermous, and the seeds albuminous.

(5079.) Exceptions. The leaves are sometimes alternate, as in *Digitalis, Maurandya,* &c. the flowers are regular and symmetrical in *Scoparia*: and a fifth stamen is occasionally developed, as in *Pentstemon*, but it is imperfect, the anther being absent.

(5080.) *SCROPHULARIDÆ.* Scrophularineæ, *Lind.* Antirrhineæ, *De Cand.*

GEN. RULE. Ib. The bracteæ being simple, the stigma 2-lobed, and the radicle hilose.

(5081.) *RHINANTHIDÆ.* Rhinanthaceæ, *Lind.* Melampyraceæ, *Rich.*

GEN. RULE. Ib. Bracteæ crested, stigma obtuse, embryo inverted, radicle abhilose.

(5082.) *UTRICULARIACEÆ.* Lysimachiis Aff., *Juss.* Lentibulariæ, *R. Brown.* Utriculinæ, *Link* and *Hoffmannseg.*

GEN. RULE. Hypocorollous synpetalous exogenæ (or Primulosæ), with irregular flowers, two fertile, and 0 barren stamens, capsule free, 1-celled, placenta central, free, and polyspermous.

(5083.) *Obs.* Aquatic herbs with variable leaves often degenerate and root-like. The embryo is sometimes undivided, and has been considered by several authorities as acotyledonous.

(5084.) *MENTHACEÆ.* Labiatæ, *Juss.* Verticillatæ, *Lin.*, *Ray.*

GEN. RULE. Hypocorollous synpetalous exogenæ (or Primulosæ), with irregular unsymmetrical flowers, stamina 2-4, usually didynamous, ovarium deeply 4-lobed, style basal, seeds solitary and erect.

(5085.) *Obs.* Stems usually herbaceous, and square, leaves opposite and exstipulate, and the inflorescence in verticillastri. The four carpels of the germen sometimes become reduced in number in the fruit by abortion.

(5086.) *VERBENACEÆ.* VITICES, *Juss.*

GEN. RULE. Hypocorollous synpetalous exogenæ, with irregular unsymmetrical flowers, corolla sub-labiate, stamens didynamous, disk 0, germen undivided, style terminal, fruit 2-4-celled, seeds definite and wingless.

(5087.) *VERBENIDÆ.* VITICIBUS AFF., *Juss.* PYRENACEÆ, *Vent.*

GEN. RULE. Bracteæ solitary, fruit 2-4-celled, seed 1, radicle inferior.

(5088.) *MYOPORIDÆ.* MYOPORINÆ, *Brown.*

GEN. RULE. Ib. The flowers being ebracteate, the ovules definite and pendulous, the fruit drupaceous and indehiscent, the seeds albuminous, and the radicle superior.

(5089.) EXCEPTION. Albumen often spare, and sometimes altogether absent.

(5090.) *SELAGINIDÆ.* SELAGINEÆ, *Juss.*, *Choisy*, &c. VITICIBUS AFF., *Juss.*

GEN. RULE. Ib. The flowers being unibracteate, ovarium 2-celled, ovules definite and pendulous, seeds albuminous, and the radicle superior.

(5091.) *Obs.* The ovules are said by some authorities to be erect.

(5092.) *BIGNONIACEÆ.* PERSONATÆ (part of), *Lin.* and *Link.* BIGNONIÆ (part of), *Juss.* BIGNONIACEÆ, *Brown.*

GEN. RULE. Hypocorollous synpetalous exogenæ, with irregular unsymmetrical flowers, a capsular fruit, and compressed, winged, exalbuminous seeds.

(5093.) *Obs.* The capsule is mostly 2-celled, but it is sometimes spuriously 4-celled; and in *Eccremocarpus* the fruit is unilocular.

(5094.) *ACANTHACEÆ.* PERSONATÆ (part of), *Lin.* ACANTHI (part of), *Juss.* ACANTHACEÆ and PEDALINEÆ, *Brown.*

GEN. RULE. Hypocorollous synpetalous exogenæ, with bracteate, irregular, unsymmetrical flowers, the fruit mostly 2-celled, and the seeds apterous and destitute of albumen.

(5095.) EXCEPTIONS. The fruit is sometimes 1-celled; and in the Sesamidæ frequently 4-6-celled, by the formation of spurious dissepiments.

(5096.) *SESAMIDÆ.* PEDALINEÆ, *Brown.* SESAMEÆ, *De Cand.*, *Kunth*, &c. MARTYNEACEÆ, *Link.*

GEN. RULE. Ib. The fruit being drupaceous, dry, and woody, 1-celled, or spuriously 4-6-celled, the placentæ ligneous and lobed, the seeds in general definite, and the seed-coats papery.

(5097.) EXCEPTION. The seeds are indefinite in *Sesamum.*

(5098.) *CYRTANDRIDÆ.* CYRTANDRACEÆ, *Jack.* DIDYMOCARPEÆ, *Don.*

GEN. RULE. Ib. The fruit being 1-celled, or spuriously bilocular, the placentæ membranous and double, and the seeds indefinite and minute.

(5099.) *Obs.* The fruit is sometimes capsular, and sometimes baccate, but never woody.

(5100.) *ACANTHIDÆ.* ACANTHI, *Juss.* ACANTHACEÆ, *Brown.*

GEN. RULE. Ib. The flowers being imbricate, the fruit capsular and 2-celled, dehiscing elastically, and the dissepiments hooked.

(5101.) EXCEPTIONS. The hooks of the dissepiments are not always present, and in Mendozia the fruit is drupaceous and 1-seeded.

(5102.) *Obs. Mendozia* is further remarkable for its crumpled chrysaloid cotyledons, and also for the degeneration of its calyx, which is either obsolete, or reduced to the form of an obscure ring, its place being supplied by bracteæ; a similar degeneration occurs in *Clista* and *Thunbergia*; and in *Acanthus* the upper lip of the corolla is absent.

(5103.) *OROBANCHACEÆ.* Personatæ (part of), *Lin.* Pedicularibus Aff., *Juss.* Orobancheæ, *Juss.*, *Richard*, &c. Orobanchinæ, *Link.*

GEN. RULE. Hypocorollous, synpetalous, parasitical exogenæ, with leafless, colourless, scaly stems, irregular unsymmetrical flowers, appendiculate or bearded anthers, a 1-celled ovarium, formed of two accumbent carpels, with lateral placentæ, sessile, minute, indefinite seeds, and very small inverted embryo, lying at the apex of the fleshy albumen.

(5104.) *GESNERIACEÆ.* Campanulæ et Scrophulariæ (part of), *Juss.* Gesnerieæ, *Rich.* and *Juss.* Gesneriaceæ, *Link.* Gesnereæ, *Martius.*

GEN. RULE. Synpetalous dichlamydeous exogenæ, with a free or adherent calyx, corolla more or less irregular, stamens mostly didynamous, stigma capitate, ovarium 1-celled, formed of two carpels, the placentæ projecting, 2-lobed, parietal and polyspermous; the seeds minute, indefinite, and pedicelled, and the embryo erect, and in the axis of fleshy albumen.

(5105.) Exceptions. Two stamens only are developed in *Sarmienta.* In *Gesneria, Gloxinia,* and the other genera included in the subtype Gesneridæ, the calyx is adherent to the germen.

(5106.) *BESLERIDÆ.* Beslerieæ, *Bartl.*

GEN. RULE. Ib. The ovarium superior, and the calyx free.

(5107.) Exceptions. Ovarium inferior or half inferior, and the calyx adherent to the germen.

(5108.) *GESNERIDÆ.*

GEN. RULE. Ib. The ovarium inferior or half inferior, and the calyx adherent to the germen.

ERICOSÆ.

(5109.) CLASS IX., *Juss.* Pericorollous Dicotyledons, *Rich.*

GEN. RULE. Angiospermous dichlamydeous exogenæ, or dicotyledons with synpetalous perigynous corollæ.

(5110.) Exceptions. The corolla is epigynous in *Vacciniaceæ;* and sometimes both corolla and stamens are hypogynous, as in Ebenaceæ and *Sapotaceæ.*

STYRACINÆ.

(5111.) GEN. RULE. Angiospermous exogenous trees or shrubs, with simple alternate exstipulate leaves, dichlamydeous, synpetalous, regular flowers, perigynous or hypogynous corollæ, indehiscent fruit, with central placentæ, and solitary or definite seeds, with hilose radicles.

(5112.) Exceptions. The corolla sometimes hypogynous, as *Ebenaceæ* and *Sapotaceæ.*

(5113.) *EBENACEÆ.* Guajacanæ, *Juss.* Ebenaceæ, *Juss.*, *Vent.*, *Brown*, &c. Ebenaceæ Diospyreæ, *De Cand.* and *Duby.*

GEN. RULE. Angiospermous, synpetalous, dichlamydeous exogenæ, with arborescent stems, alternate leaves, non-lactescent juices, regular separated flowers, a free superior, several-celled ovarium, definite pendulous ovules, central placenta, and albuminous seeds.

(5114.) Exception. The flowers are sometimes united.

(5115.) *SAPOTACEÆ.* Sapotæ, *Juss.* Sapoteæ, *Brown.*

GEN. RULE. Angiospermous, dichlamydeous, synpetalous exogenæ, with arborescent stems, alternate leaves, and mostly lactescent juices. The flowers are regular and united; the corolla hypogynous and imbricate in æstivation, the germen free and several-celled, the ovules solitary and erect, and the seed-coats osseous, with a large scar.

(5116.) Exception. The sap is not always milky.

(5117.) *BELVISIACEÆ.* Belvisieæ, *Brown.*

GEN. RULE. Angiospermous, dichlamydeous, synpetalous exogenæ, with

arborescent stems, simple, alternate, exstipulate leaves, regular united flowers, corolla plicate in æstivation and perigynous, germen inferior, and fruit baccate and many-seeded.

(5118.) *Obs.* The corolla is sometimes single and sometimes double, undivided or many-lobed, and deciduous; the calyx is persistent.

(5119.) *STYRACEÆ.* Bicornes, β. (part of), *Lin.* Guajacanæ (part of), *Juss.* Styracinæ vel Styraceæ, *Rich.* Ebenaceæ (part of), *De Cand.* and *Dub.* Symploceæ, *Juss.* Symplocineæ and Halesiaceæ, *Don.*

GEN. RULE. Pericorollous dicotyledons, with regular flowers, the petals imbricate in æstivation, the anthers innate and introrse, the germen inferior and several-celled; the ovules in pairs, ascending and descending, and the seeds mostly solitary and albuminous.

(5120.) *Obs.* The affinities of these plants are very questionable, and the systematic arrangement not satisfactorily determined.

ERICINÆ.

(5121.) GEN. RULE. Angiospermous, dichlamydeous, synpetalous exogenæ, with the flowers mostly regular and united, the calyx free or adnate, the corolla in general imbricate in æstivation, the stamens alternate with the petals, and equal to them in number, or twice as many, the anthers commonly 2-celled, and distinct at base or apex, the ovary 4-5 celled, and the placenta central and polyspermous.

(5122.) Exceptions. The corolla is sometimes irregular, as in *Azalea, Rhododendron,* &c. In *Ledum* the petals are scarcely coherent; and the germen in *Monotocca* is but 1-celled.

(5123.) *EPACRIDACEÆ.* Ericeæ (part of), *Juss.* Epacrideæ, *Brown,* &c.

GEN. RULE. Synpetalous, dichlamydeous, angiospermous exogenæ, with imbricated bracteæ, the calyx free, the corolla imbricate (rarely valvate) in æstivation; the anthers dry, 1-celled and without appendages, a superior several-celled ovarium, and many seeds.

(5124.) Exceptions. The seeds are sometimes definite and sometimes indefinite, and in *Monotocca* the fruit is 1-celled: the corolla is occasionally valvate in æstivation.

(5125.) *ERICACEÆ.* Bicornes, *Lin.* Ericæ, *Juss.* Ericeæ, *Brown,* Ericineæ, *Desv.* Rhodoraceæ and Ericaceæ, *De Cand.*

GEN. RULE. Synpetalous, dichlamydeous, angiospermous exogenæ, with regular or irregular flowers, 2-celled dry appendiculate anthers, a superior ovary, many-celled and many-seeded, the albumen fleshy, and the embryo axile.

(5126.) Exceptions. In *Ledum* the corolla is scarcely synpetalous, and in *Azalea* and other of the *Rhodoreæ* it is irregular.

(5127.) *ERICIDÆ.* Ericeæ, *Auct.* The Pyrolidæ, excepted. Ericeæ, *Lind.*

GEN. RULE. Ib. The stems being ligneous, the style straight, and the seeds apterous.

(5128.) Exceptions. The seeds are occasionally but very rarely winged, as in a species of *Erica* mentioned by Dr. Brown. The anthers are sometimes without appendages.

(5129.) *PYROLIDÆ.* Monotropeæ, *Nutt.* Pyroleæ, Pyrolaceæ, *Lind.*

GEN. RULE. Ib. The stem being herbaceous, the seeds winged, and the testa loose and reticulate.

(5130.) Exceptions. In three species of *Pyrola,* viz. *P. uniflora, secunda,* and *minor,* the style is erect, not declinate; in one other species, *Pyrola secunda,* the stem is rather woody; and in P. aphylla the leaves are absent, their place being supplied by scales.

(5131.) *VACCINIACEÆ.* Bicornes (part of), *Lin.* Ericæ (part of), *Juss.* Vaccinieæ, *De Cand.* &c.

GEN. RULE. Synpetalous, dichlamydeous, angiospermous exogenæ, with a regular epigynous corolla, imbricate in æstivation, 2-celled appendiculate anthers,

an inferior 4-5-celled ovarium, becoming a baccate fruit; seeds small and numerous, and the embryo straight, and in the axis of fleshy albumen.

(5132.) *Obs.* The epigynous corolla would associate these plants with the *Asterosæ,* were it not for their close affinity in all other particulars with the *Ericaceæ.*

CAMPANULINÆ.

(5133.) GEN. RULE. Angiospermous, dichlamydeous, synpetalous exogenæ, with imperfectly nodose stems, and simple exstipulate leaves; the calyx in general adnate to the germen, corolliferous and staminiferous; the stamens alternate with the petals, and equal to them in number or fewer, and the placenta central and polyspermous.

(5134.) EXCEPTIONS. In the *Lobelidæ* the petals are sometimes discrete; in *Goodenovidæ* the calyx is inferior, while the corolla is superior.

(5135.) *CAMPANULACEÆ.* CAMPANACEÆ (part of), *Lin.* CAMPANULACEÆ, *Juss. Brown,* &c.

GEN. RULE. Pericorollous, angiospermous dicotyledons, for the most part lactescent, with exstipulate simple alternate (rarely opposite) leaves, corolla valvate in æstivation, stamens not gynandrous, style pilose or fringed, but not indusiate, ovary inferior and many-seeded.

(5136.) EXCEPTIONS. The leaves are sometimes opposite in *Campanulidæ,* and the petals discrete or separable in *Lobelidæ.*

(5137.) *LOBELIDÆ.* CAMPANACEÆ et CAMPANULACEÆ (part of), *Lin., Juss., Brown,* &c. LOBELIACEÆ, *Lind.*

GEN. RULE. Ib. The corolla being irregular, the anthers syngenesious, and the pollen oval.

(5138.) EXCEPTION. The petals are sometimes discrete.

(5139.) *Obs.* The flowers are usually united, but one species of *Lobelia* is diœcious.

(5140.) *CAMPANULIDÆ.* CAMPANACEÆ et CAMPANULACEÆ (part of), *Lin., Juss., Brown,* &c. CAMPANULEÆ, *Alph., Del.* CAMPANULACEÆ, *Lind.*

GEN. RULE. Ib. The corolla being regular, the anthers discrete, the pollen round.

(5141.) EXCEPTIONS. Leaves sometimes (but rarely) opposite, and occasionally deeply cleft. Ovary sometimes half superior

(5142.) *STYLIDIACEÆ.* STYLIDEÆ, *Brown.*

GEN. RULE. Pericorollous, synpetalous, angiospermous exogenæ, with the corolla imbricate in æstivation; the flowers gynandrous and the seeds indefinite, with a fleshy suboleose albumen.

(5143.) *Obs.* The corolla is usually irregular, but occasionally its lobes are found regular.

(5144.) *GOODENIACEÆ.* CAMPANULACEÆ (part of), *Juss.* GOODENOVIEÆ, *Brown.*

GEN. RULE. Pericorollous, synpetalous, angiospermous dicotyledons, non-lactescent, with an irregular or subregular corolla, induplicate in æstivation, and the stigma indusiate.

(5145.) EXCEPTIONS. In the *Goodenovidæ* the calyx is sometimes inferior, the corolla being superior; in the *Brunonidæ* the flower is altogether inferior, and the germen superior, yet the fruit is invested by the indurated tube of the calyx; while in the *Scævolidæ* the normal condition of the suborder prevails, the germen being inferior and the flower superior. These gradations of structure are peculiarly interesting and instructive.

(5146.) *GOODENOVIDÆ.* GOODENOVIEÆ, *Brown,* &c.

GEN. RULE. Ib. The fruit capsular, 2-4-celled, and the seeds indefinite and albuminous.

(5147.) EXCEPTIONS. The petals are sometimes separable from each other.

(5148.) *SCÆVOLIDÆ.* GOODENOVIEÆ et SCÆVOLEÆ, *Brown.* SCÆVOLEÆ, *Lind.*

GEN. RULE. Ib. The fruit indehiscent, drupaceous or nutlike, 1-4-celled, seeds 1-2, with fleshy albumen. (4288.)

(5150.) EXCEPTIONS. One species of *Scævola*, a native of Molucca, has opposite leaves.

(5151.) *BRUNONIDÆ.* GOODENOVIEÆ (part of), *Brown.* BRUNONIACEÆ *Lind.*

GEN. RULE. Ib. The *inflorescence capitate*, the corolla nearly regular, the germen superior, the fruit a membranous utricle, included within the indurated tube of the calyx, and the seed solitary and exalbuminous. (4287.)

(5152.) *ASTEROSÆ.*

COMPOSITÆ et C. AFFINES, *Ray.* COMPOSITÆ AGGREGATÆ, &c. (part of), *Lin.* CLASSES X. and XI., *Juss.* SYNANTHEREÆ et CORISANTHEREÆ, *Rich.* COMPOSITÆ et (part of) AGGREGATÆ, *Bartl.*

GEN. RULE. Epicorollous syringales, or dichlamydeous, synpetalous, angiospermous dicotyledons, with an epigynous corolla. (4109.)

(5153.) EXCEPTION. In some of the *Dipsaceæ* the germen is scarcely inferior; at least, the calyx is only in part adherent to the ovarium. [4198.]

(5154.) *ASTERINÆ.*

COMPOSITÆ, *Ray* and *Lin.* CLASS X., *Juss.* COMPOSITÆ, *Bartl.* SYNANTHEREÆ, *Rich.*

GEN. RULE. Epicorollous, synpetalous, angiospermous dicotyledons, with a capitate inflorescence, the corolla valvate in æstivation, and the stamens more or less united; in general, strictly syngenesious. (4202.)

(5155.) EXCEPTIONS. In *Xanthium, Franziera,* and *Kuhnia,* the anthers are discrete; and in imperfect florets they are often not coherent.

(5156.) *ASTERIANÆ.*

COMPOSITÆ, *Ray, Lin.*, &c. SYNANTHEREÆ, *Rich.*, *Cassini*, &c.

GEN. RULE. Epicorollous, synpetalous, angiospermous dicotyledons, with a capitate inflorescence, the corolla valvate in æstivation, and the anthers strictly connate, seeds erect, and albumen none, or very spare. (4208.)

EXCEPTIONS. Vide (5155.)

(5157.) *CICHORACEÆ.* COMPOSITÆ LACTESCENTES or PLANIPETALÆ, *Ray.* SEMIFLOSCULOSÆ, *Lin.* and *Tourn.* CICHORACEÆ, *Juss.*, &c. LACTUCEÆ, *Rich.*, *Bart.*, &c.

GEN. RULE. Ib. Flowers united, all ligulate or unilabiate, both in ray and disk, sap mostly lactescent. (4221.)

(5158.) *MUTISIACEÆ.* LABIATIFLORÆ, *De Cand.* MUTISIEÆ, *Bartl.*

GEN. RULE. Ib. The flowers being bilabiate, the receptacle naked, and the alternate leaves sometimes cirrhiferous. (4226-65.)

(5159.) *CYNARACEÆ.* COMPOSITÆ CAPITATÆ. *Ray* and *Lin.* FLOSCULOSÆ, *Tourn.* CYNAROCEPHALÆ, *Juss.* CARDUACEÆ, *Rich.*

GEN. RULE. Ib. Florets all tubular both in ray and disk, receptacle chaffy, often fleshy, style nodose and hairy, leaves often prickly.

(5160.) *ASTERACEÆ.* CORYMBIFERÆ et DISCOIDEÆ, *Ray.* RADIATÆ, *Tourn.* DISCOIDEÆ, OPPOSITIFOLIÆ et NUCAMENTACEÆ, *Lin.* CORYMBIFERÆ, *Juss.*

GEN. RULE. Florets tubular on the disk, mostly ligulate in the ray, receptacle not fleshy, style not tumid. (4219.)

(5161.) EXCEPTIONS. In *Xanthium, Franziera,* &c. the anthers are not syngenesious.

(5162.) *Obs.* The ligulate florets of the ray become in many cases few in number, and a gradual depauperation may be observed, until at last they are altogether abortive. This is remarkably the case in the genus Senecio, most of the species of which have a well developed ray, while in *S. sylvaticus* it is revolute and obscure, and in *S. vulgaris* obsolete. The ray is also

wanting in others, as in *Tanacetum, Artemisia, Eupatorium, Conyza, Gnaphalium, Chrysocoma Xanthium*, &c.

The leaves, which in this order are usually alternate, are opposite in the group, hence called by Linneus *Compositæ Oppositifoliæ ; Bidens, Coreopsis, Helianthus, Rudbeckia*, and *Tagetes*, may be mentioned as examples.

(5163.) *CALYCERIANÆ.*

GEN. RULE. Epicorollous, synpetalous, angiospermous dicotyledons, with a capitate inflorescence, the corolla valvate in æstivation, the stamens semi-connate or subsyngenesious, and the seed pendulous, with a fleshy albumen. (4207.)

(5164.) *Obs.* The filaments are connected; hence these plants are monadelphous as well as synantherous.

(5165.) *CALYCERACEÆ.* Boopideæ, *Cassini.* Calycereæ, *Brown.*

GEN. RULE. The characters of this single type are the same with those of the subsection. (4210.)

VALERINÆ.

(5166.) Corymbiferis Affines et Sequentes, *Ray.* Aggregatæ (part of), *Lin.* and *Bartl.* Class XI., *Juss.* Corisanthereæ, *Rich.*

GEN. RULE. Epicorollous synpetalous exogenæ, with a staminiferous corolla, imbricate in æstivation, the filaments and anthers discrete, the ovarium inferior, 1-3-celled, seed solitary and pendulous, and the radicle superior. (4186.)

(5167.) Exceptions. Vide (5069.)

(5168.) *DIPSACEÆ.* Dipsaceæ (part of), *Juss.*, &c.

GEN. RULE. Epicorollous dicotyledons, with a capitate inflorescence, corolla imbricate in æstivation, the stamens induplicate, the ovarium inferior, 1-celled, with a solitary pendulous seed, the embryo being in the axis of fleshy albumen. (4191.)

(5169.) Exceptions. In some species of *Scabiosa* the calyx is only in part adherent to the germen.

(5170.) *VALERIANACEÆ.* Dipsaceæ (part of), *Juss.*, Valerianæ, *De C.*

GEN. RULE. Epicorollous synpetalous dicotyledons, with a cymose or corymbiform inflorescence, the germen inferior, 3-celled, fruit 1-celled, seed solitary, pendulous and exalbuminous. (4187.)

(5171.) *RUBIACINÆ.*

STELLATÆ, Ray. Stellatæ (part of), *Lin.* Rubiaceæ et Caprifolia, *Juss.*, &c.

GEN. RULE. Epicorollous synpetalous exogenæ or dicotyledons, with nodoso-articulated stems, opposite or verticillate leaves, stamens discrete and alternate with the lobes of the corolla, carpels 2-3-connate, ovules 1 or many, with the radicle mostly next the hilum. (4114.)

(5172.) *RUBIACEÆ.* Rubiaceæ (part of), *Juss.* and *De Cand.* Stellatæ, *Lind.* Galieæ, *Turp.*

GEN. RULE. Epicorollous synpetalous exogenæ, with angular nodoso-articulated stems, verticillate exstipulate leaves, an inferior didymous ovarium, and solitary erect seeds, with horny albumen. (4178.)

(5173.) *Obs.* Two opposite leaves only at each node bear buds; hence the intermediate ones are probably stipules, although undistinguishable in form from the true leaves.

(5174.) *CINCHONACEÆ.* Rubiaceæ (part of), *Juss.*, *De Cand.*, &c. Cinchonaceæ, *Lind.*

GEN. RULE. Epicorollous synpetalous exogenæ, with nodoso-articulated stems, opposite entire leaves, and interpetiolar stipules, ovarium mostly 2-celled, seeds definite or indefinite, and the albumen fleshy or corneous. (4125.)

(5175.) Exceptions. The ovary is sometimes multilocular, and in *Pomax* and *Opercularia* it is but 1-celled and 1-seeded. The small group *Opercularidæ* is further remarkable for the number of the stamens being unequal to the petals.

Obs. For subtypes and districts, vide (§ 4128.)

(5176.) *CAPRIFOLIACEÆ.* Dumosæ β. *Lin.* Caprifolia, *Juss.* Caprifoliaceæ, *De Cand.*, &c.

GEN. RULE. Epicorollous synpetalous dicotyledons, with opposite exstipulate or substipulate leaves, the germen formed of 2-4-connate carpels, the seeds pendulous, the albumen fleshy, and the embryo straight. (4115.)

(5177.) *LONICERIDÆ.* Lonicereæ, *A. Rich.* Caprifolieæ, *De Cand.* and *Duby.*

GEN. RULE. Ib. Corolla mostly irregular, style filiform, leaves entire, stipules none. (4119.)

(5178.) *SAMBUCIDÆ.* Sambucineæ, *A. Rich.*

GEN. RULE. Ib. Corolla regular, stigmata 3 and sessile, and the leaves serrate and substipulate. (4118.)

ROSALES.

(5179.) Dicotyledones Polypetalæ, *Juss.* Epipetalæ, Hypopetalæ et Peripetalæ, *Rich.* Thalamifloræ and part of Calycifloræ, *De Cand.*

GEN. RULE. Apopetalous, dichlamydeous, angiospermous exogenæ or dicotyledons, with seed-vessels, a double floral envelope, and discrete petals. (1899.)

(5180.) Exceptions. The corolla is occasionally abortive, and sometimes the petals are more or less coherent.

(5181.) *RHÆADOSÆ.*

CLASS XIII., *Juss.* Hypopetalæ, *Rich.* Thalamifloræ, *De Cand.*

GEN. RULE. Thalamiflorous or hypogynous, apopetalous, dichlamydeous exogenæ or dicotyledons, with the seeds in proper seed-vessels, a double floral envelope, discrete petals, and hypogynous stamens and corolla. (3472.)

(5182.) Exceptions. In *Leeaceæ* the corolla is synpetalous, and in a few other instances the petals are more or less coherent or absent.

(5183.) *Obs.* The sepals as well as the petals are commonly discrete, and the torus, when present, is not adherent either to the ovaries or the calyx.

(5184.) *VITINÆ.*

Vites et Meliæ, *Juss.* Ampelideæ, *Bartl.*

GEN. RULE. Thalamiflorous angiospermous dicotyledons, with the petals discrete, broad at the base, and valvate in æstivation, the stamens definite, and often monadelphous, germen undivided, 2 or more-celled, style single, and placentæ central. (3477.)

(5185.) Exception. In *Leeaceæ* the petals are coherent.

(5186.) *LEEACEÆ.* Vites (part of), *Juss.* Ampelideæ (part of), *De Cand.*

GEN. RULE. Thalamiflorous angiospermous dicotyledons, with connate petals, valvate in æstivation, the stamens equal in number to the lobes of the corolla and alternate with them, and often monadelphous, the germen undivided, 3-6-celled, the cells 1-ovuled, the albumen lobed, the embryo bowed, and the branches nodoso-articulate, but destitute of tendrils. (3480.)

(5187.) *VITEACEÆ.* Hederaceæ (part of), *Lin.* Vites (part of), *Juss.* Sarmentaceæ (part of), *Vent.* Viniferæ, *Juss.* Ampelideæ, *Kunth.*

GEN. RULE. Thalamiflorous angiospermous dicotyledons, with discrete petals, broad at the base, and valvate in æstivation, stamens equal in number and opposite to them, the germen entire, 2-celled, the ovules 2 and collateral, the albumen hard, and the embryo erect. The stems are nodoso-articulate, and often cirrhose.

(5188.) *MELIACEÆ.* Meliæ, *Juss.* Meliaceæ, *De Cand.*, &c.

GEN. RULE. Apopetalous, thalamiflorous, angiospermous exogenæ, with the stamens double the petals in number (rarely equal), and often monadelphous, the ovarium undivided, of several cells, and the ovules definite and pendulous. The stems non-scandent and excirrhose. (3503.)

(5189.) Exceptions. The filaments are occasionally free, and the stamens sometimes equal to the petals in number, or more than twice as many.

(5190.) *HUMIRIDÆ.* Humiriaceæ, *Ad. de Juss.*

GEN. RULE. Ib. The sepals having an imbricate, and the corolla a quincuncival æstivation, the stamina numerous, simply monadelphous, the connectivum dilated, the carpels 5 and connate, the axis of the fruit woody, the seeds definite and pendulous, and the leaves coriaceous and dotless. (3500.)

(5191.) *MELIDÆ.* Melieæ, *Juss.* and *De Cand.* Meliaceæ, *Lind.*

GEN. RULE. Ib. The sepals being imbricate and the petals valvate in æstivation, the filaments definite, connate, forming an antheriferous tube, the connectivum undilated, the fruit plurilocular, and the seeds exalbuminous and wingless. (3501.)

(5192.) *MELIEÆ.* Ib. Cotyledons flat and foliaceous, and the leaves mostly simple.

(5193.) *TRICHILIEÆ.* Ib. Cotyledons, very thick, and the leaves pinnate or trifoliate, rarely simple.

(5194.) *CEDRELIDÆ.* Meliæ (part of), *Juss.* Meliaceæ, Cedreleæ, *De Cand.* Cedreleæ, *Brown*, &c.

GEN. RULE. Ib. The sepals and petals being imbricate in æstivation, the stamens definite, and mostly connate, the ovary several-celled, and the seeds indefinite, sub- or ex-albuminous, and winged. (3502.)

(5195.) *FLINDERSIEÆ.* Ib. The leaves being pellucido-punctate.

(5196.) *CEDRELEÆ.* Ib. The leaves being dotless.

(5197.) *CISTINÆ.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens and corolla, the germen symmetrical, the carpels connate, the placenta parietal or subparietal (rarely central), the sepals imbricate in æstivation, and the leaves with or without pellucid dots. (3524.)

(5198.) Exceptions. In *Maregraviaceæ* the petals are sometimes connate.

(5199.) *HYPERICIANÆ.*

Hypericæ et Guttiferæ, *Juss.* Guttiferæ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens, the sepals imbricate, and the petals mostly contorted in æstivation, the placentæ sub-central and many-ovuled, the seeds exarillate, the embryo straight, and the cotyledons entire. (3625.)

(5200.) *GARCINIACEÆ.* Guttiferæ, *Juss.* Garcinieæ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous indefinite unequal stamens and adnate linear anthers; the sepals irregular, persistent, and imbricate in æstivation, the germen formed of several connate carpels, having a central or subcentral placenta, the styles usually connate and short, and the seeds apterous, the peduncles articulated, the leaves simple, exstipulate, coriaceous (mostly opposite), and the juices often resiniferous. (3528.)

(5201.) Exceptions. In the *Calophyllidæ* the germen is 1-celled, and in *Calophyllum* the petals are opposite the sepals. In *Havetia* of the *Clusidæ* the anthers are immersed in a fleshy disk.

(5202.) Note. For characters of subtypes vide (§ 3531-2-3-4.)

(5203. *HYPERICACEÆ*. HYPERICA, *Juss.* HYPERICINÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous indefinite stamens, the filaments connate, mostly polyadelphous, and the anthers versatile; the styles filiform, rarely connate, the germen formed of several connate carpels, with central or subcentral placentæ, and the seeds in general indefinite; the sepals are mostly unequal and imbricate in æstivation, the leaves opposite and pellucido-punctate, and the juices resinous. (3548.)

(5204.) EXCEPTIONS. Some species of *Vismia* are said to have solitary seeds; the stamens, which are usually indefinite and polyadelphous, are definite (10), and monadelphous in *Laneritia.*

(5205.) NOTE. For the characters of the subtypes, vide (§ 3551-2-3.)

(5206.) *FRANKENIACEÆ*. *Augt. St. Hilaire, De Cand.* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous definite stamens, anthers roundish, versatile, and dehiscent by pores, the germen formed of several carpels, the capsule 1-celled, with parietal placentæ, and a septicidal dehiscence; the juices are non-resinous.

(5207.) EXCEPTIONS. In some *Luxemburgiæ* the stamens are indefinite.

(5208.) *FRANKENIDÆ*. FRANKENIACEÆ, *Don.*

GEN. RULE. Ib. The calyx being synsepalous and tubular, the petals with claws the length of the sepals, and the stamens six.

(5209.) *SAUVAGESIDÆ*. SAUVAGEÆ. Part of FRANKENIACEÆ, *Don.* Part of VIOLARIEÆ, *De Cand.*

GEN. RULE. Ib. The sepals and petals being exunguiculate and spreading, the flowers usually furnished with an urceolus or nectary, and the stamens 5 or 7, or, as in some species of Luxemburgia, indefinite.

(5210.) *CISTIANÆ*.

CISTI, *Juss.* CISTIFLORÆ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens, a symmetrical free germen, the placentæ parietal, and the seeds mostly arillate or appendiculate, the embryo variable, and the cotyledons foliaceous. (3526.)

(5211.) EXCEPTIONS. In the *Marcgravidæ* the petals are coherent and calyptriform; the corolla is wanting in the *Flacourtidæ*, and in the *Bixaceæ* the flowers are often apetalous.

(5212.) *VIOLACEÆ*. PENTAPETALÆ IRREGULARES, *Ray.* CAMPANACEÆ, (part of), *Lin.* CISTIS AFF, *Juss.* IONIDIA, *Vent.* VIOLACEÆ, *Juss.* VIOLEÆ, *Brown.* VIOLARIEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with the sepals imbricate, and the petals obliquely convolute in æstivation. The stamens equal the petals in number (5). The filaments elongated beyond the anthers, style 1 and undivided; ovarium 1-celled, with narrow parietal placenta, and a loculicidal dehiscence. The seeds albuminous, the embryo erect, and the leaves furnished with stipules. (3566-7.)

(5213) EXCEPTIONS. (Vide 5216.)

(5214.) *VIOLIDÆ*. VIOLEÆ, *De Cand.* VIOLEA, *Bartl.*

GEN. RULE. Ib. The sepals irregular and the petals unequal, filaments free and dilated. (3569.)

(5215.) *ALSODIDÆ*. Ib. The flowers regular, stamens usually connected at the base, or adhering to the inside of a cup-shaped nectary. (3570.)

(5216.) EXCEPTIONS. In Pentaloba the fruit is 5-lobed, the style however is single. In *Hymenanthera*, sometimes referred to this group, the fruit is 2-celled; and in *Piparea* it is 1-3-celled.

(5217.) *DROSERACEÆ.* Gruinales (part of), *Lin.* Capparid. Aff., *Juss.* Drosereæ, *Salisb.* Droseraceæ, *De Cand.* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, the carpels concrete, but the styles distinct or nearly so; the placentæ parietal and narrow, and the embryo erect. The leaves furnished with ciliate stipules, and, like the peduncles, circinnate in vernation. (3574-5.)

(5218.) Exception. In *Dionæa* the vernation is not circinnate.

(5219.) *CISTACEÆ.* Pentapetaleæ, Vasculiferæ (part of), *Ray* Cisti, *Juss.* Cistoideæ, *Vent.* Cistineæ, *De Cand.* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite hypogynous stamens, calyx pentasepalous, and with the corolla contorted in æstivation; a superior 1-celled or spuriously many-celled ovarium; narrow parietal placentæ, indefinite seeds, naked seed-coats, and a curved or spiral inverted embryo. The leaves are impunctate. (3578-9.)

(5220.) *BIXACEÆ.* Bixineæ, *Kunth, De Cand.* &c.

GEN. RULE. A- or apo-petalous angiospermous dicotyledons, with indefinite hypogynous stamens, the sepals 4-7, imbricate in æstivation. The ovary superior, 1-celled, with narrow parietal placentæ; the seeds arillate or included in pulp, and the embryo erect. The leaves are usually pellucido-punctate or glabrous. (3581-2.)

(5221.) Exceptions. The flowers in half the genera of this small type are apetalous, and the leaves are sometimes impunctate.

(5222.) *FLACOURTIACEÆ.* Flacourtianeæ, *Rich. De Cand.*, &c.

GEN. RULE. A- or apo-petalous dicotyledons, with hypogynous stamens, a superior 1-celled ovarium, with branched parietal placentæ, seeds few, and the embryo straight. (3585-6.)

(5223.) Exception. To the general rule of the §, vide (5197.) *Flacourtidæ.*

(5224.) *FLACOURTIDÆ.* Flacourtieæ et Patrisieæ, *De Cand.*

GEN. RULE. Ib. The flowers being apetalous. (3588.)

(5225.) *ERYTHROSPERMIDÆ.* Erythrospermeæ et Kiggelarieæ, *De Cand.*

GEN. RULE. Ib. The flowers being apopetalous. (3589.)

(5226.) *MARCGRAVIACEÆ.* Marcgravieæ, *De Cand., Bartl.* &c.

GEN. RULE. Syn- or apo-petalous angiospermous dicotyledons, with indefinite (or definite) stamens, the ovarium superior, of several incomplete cells, with subparietal (? central) placentæ; the seeds indefinite, minute, and pulpose. (3594-5.)

(5227.) *MARCGRAVIDÆ.* Marcgravieæ, *De Cand.*

GEN. RULE. Ib. The petals being coherent, the corolla calyptriform, and the stamens distinctly hypogynous. (3597.)

(5228.) *NORANTIDÆ.* Norantiæ, *De Cand.*

GEN. RULE. Ib. The petals being discrete, and the stamens so closely pressed on the corolla as to appear as if exserted from it. (3598.)

(5229.) *TAMARICACEÆ.* Portulaceæ (part of), *Juss.* Tamariscineæ, *Desvaux, De Cand.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with (in general) definite hypogynous stamens, sepals and petals imbricate in æstivation; the ovary superior, 1-celled, 3-valved, and many-seeded; the placentæ parietal or basal, and he seeds erect or ascending, with comose, hairy, or villose seed-coats. (3600-1.)

(5230.) *DIANTHINÆ.*

PENTAPETALÆ VASCULIFERÆ (part of), *Ray.* CARYOPHYLLEI, *Lin.* CARYOPHYLLÆ, *Juss.* CARYOPHYLLINÆ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, calyx and corolla imbricate in æstivation, the germen superior, undivided, 1 or more celled, with central placentæ, and numerous seeds; the stems are fistulose and nodose, and the leaves opposite, exstipulate, and entire. (3605.)

(5231.) EXCEPTION. The petals are sometimes absent in the *Dianthaceæ.*

(5232.) *ELATINACEÆ.* ELATINEÆ, *Cambessedes,* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous discrete stamens, alternate with the petals, the germen superior, 3-5-celled, with axial placentæ and numerous seeds. The stigmata are capitate, the seeds exalbuminous, and the embryo straight. (3607-8.)

(5233.) EXCEPTION. In *Merimea* the dissepiments separate from the axis.

(5234.) *DIANTHACEÆ.* CARYOPHYLLEÆ (part of), *Lin., Juss,* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, the stigmata simple and filiform, germen superior, 1 or more-celled, with central placentæ, many seeds, mealy albumen, and curved embryo. (3610-1.)

(5235.) EXCEPTION. The petals are sometimes absent, as in *Sagina,* &c.

(5236.) *SILENIDÆ.* SILENEÆ, *De Cand., Bartl.,* &c.

GEN. RULE. 1b. The sepals being connate and forming a tube, the torus columnar, discrete, and the germen 1 or more celled. (3613.)

(5237.) *ALSINIDÆ.* ALSINEÆ, *De Cand., Bartl.*

GEN. RULE. Ib. The sepals being discrete or nearly so, not forming a tube, the torus adherent to the calyx, not columnar, and the germen 1-celled. (3614.)

GERANINÆ OR *GRUINÆ.*

(5238.) GRUINALES, *Lin.* GERANIA, *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with the sepals imbricate and the petals imbricate or contorted in æstivation; the stamens definite and hypogynous, the carpels aggregate or connate, and the seeds in general few, or, when many, exalbuminous. (3618.)

(5239.) EXCEPTIONS. The petals are occasionally absent, as in *Rhyncotheca* of the *Geranidceæ,* and the sepals are said to be valvate in *Tropæolum pentaphyllum.*

(5240.) *LINACEÆ.* LINEÆ, *De Cand.,* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with symmetrical flowers; the sepals imbricate and the petals contorted in æstivation, the stamens definite, hypogynous, and submonadelphous; the carpels 3-5, connate, the stigmata capitate, the fruit capsular, superior, several-celled, with central placentæ, and definite (sub-solitary) pendulous seeds, the embryo straight, the cotyledons flat, and the leaves simple and exstipulate. (3620-1.)

(5241.) *OXALIDACEÆ.* OXALIDEÆ, *De Cand.*

GEN. RULE Apopetalous angiospermous dicotyledons, with symmetrical flowers; the petals spirally convolute in æstivation, the stamens definite, hypogynous, distinct or sub-monadelphous. The germen formed of 5 connate carpels, the placentæ axial, the seeds few, albuminous, and arillate. The embryo straight, cotyledons foliaceous, and the leaves compound. (3624-5.)

(5242.) *BALSAMINACEÆ.* BALSAMINEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with unsymmetrical flowers; one of the sepals spurred, and the petals coherent in pairs, the carpels concrete, the ovary superior, imperfectly 5-celled, and the seeds numerous, pendulous, and exalbuminous; the leaves simple and exstipulate. (3631-2.)

(5243.) *HYDROCEREÆ. Blume.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with symmetrical irregular flowers, one of the sepals being calcarate, the stamens definite and hypogynous, the anthers slightly connate, the germen superior, formed of several connate carpels, with central placentæ, the fruit drupaceous, and the seed solitary, pendulous, and exalbuminous. (3637-8.)

(5244.) *TROPÆOLACEÆ.* Tropæoleæ, *Juss., De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with irregular unsymmetrical flowers, the æstivation of the calyx quincuncial, and the upper sepal calcarate, the stamina definite and hypogynous, the carpels more or less connate, with axial placentæ, and the seeds solitary, pendulous, and exalbuminous. The leaves are simple and exstipulate. (3639.)

(5245.) Exceptions. In *Magallana* the stamens are connate at the base, and the fruit is 1-celled and 1-seeded, but this is by abortion, and its 3 wings shew its 3-fold nature. In *Tropæolum pentaphyllum* the sepals have a valvate æstivation; the cotyledons are often conferruminate.

(5246.) *GERANIACEÆ, De Cand.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with symmetrical flowers, definite hypogynous monadelphous stamens, the sepals imbricate, and the corolla contorted in æstivation, the carpels 5 in number, adherent round a woody axis, from which they separate elastically when ripe; each carpel is 1-celled, with a single pendulous ovule. The seeds are exalbuminous and exarillate, and the embryo curved, with convolute or plicate cotyledons. (3642-3.)

(5247.) Exception. In *Rhyncotheca* the petals are absent and the seeds albuminous.

MALVINÆ.

(5248.) Columniferæ, *Lin.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons or exogenæ, with hypogynous stamens, the germen superior, formed of several carpels, either discrete or connate, with axial placentæ. The leaves are simple and alternate. (3647.)

(5249.) Exception. Petals sometimes absent.

MALVIANÆ.

(5250.) Columniferæ, *Bartl.* Columniferæ, *Lin.*

GEN. RULE. Ib. The sepals being valvate, and the petals contorted in æstivation, and the leaves furnished with stipules. (3648.)

(5251.) Exception. The sepals are sometimes imbricate, and the petals occasionally absent.

(5252.) *MALVACEÆ.* Malvaceæ (part of), *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous monadelphous stamens, the anthers 1-celled and dehiscent transversely, the carpels several, discrete or coherent, the embryo straight, the radicle hilose, and the cotyledons crumpled; the sepals persistent and valvate in æstivation, the petals contorted, the leaves simple, alternate, and stipulate, and the pubescence stellate. (3650.)

(5253.) Exception. Petals wanting in *Cheirostemon* of the *Bombacidæ*.

(5254.) *MALVIDÆ.* Malveæ, *Aug. St. Hilaire.* Malvaceæ, *Kunth.*, *Lind.*, &c.

GEN. RULE. Ib. The sepals being exactly valvate, and the staminiferous tube uncleft.

(5255.) EXCEPTIONS. The carpels, which are usually arranged in a single whorl, are numerous and capitate in *Malope*. (3654.)

(5256.) *BOMBACIDÆ*. BOMBACEÆ, *Kunth*, &c.

GEN. RULE. Ib. The sepals subvalvate, and the staminiferous tube 5-cleft. (3655.)

(5257.) EXCEPTIONS. The petals are sometimes wanting, as in *Cheirostemon;* and the æstivation both of calyx and corolla is somewhat variable and doubtful.

(5258.) *BROMACEÆ*. MALVACEÆ (part of), *Juss.* STERCULIACEÆ, &c. *Auct.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous monadelphous stamens and 2-celled anthers, dehiscent lengthwise. The ovary is superior, formed of several carpels, usually concrete, with axial placentæ; the sepals are valvate, the petals convolute in æstivation, the leaves simple, alternate, stipulate, and often with a stellate pubescence. (3674.)

(5259.) EXCEPTIONS. The petals sometimes absent, as in *Sterculia* and *Erythropsis*, the carpels in which genera are also discrete; and in *Waltheria* 4 out of the 5 carpels are abortive.

(5260.) *DOMBEYIDÆ*. DOMBEYACEÆ, *Kunth.*

GEN. RULE. Ib. The calyx being persistent, the petals flat, the stamens numerous, and the albumen fleshy. (3677.)

(5261.) *HERMANNIDÆ*. HERMANNIACEÆ, *Kunth.*

GEN. RULE. Ib. The calyx being tubular and persistent, the petals flat, the stamens definite (5), and opposite the petals, the seeds many in each cell, the albumen fleshy or mealy, and the embryo mostly curved. (3678.)

(5262.) *BUTTNERIDÆ*. BUTTNERIACEÆ, *Kunth, Brown*, &c.

GEN. RULE. Ib. With persistent sepals, irregular hollow-arched petals, which are sometimes small or abortive, and the albumen occasionally absent. (3679.)

(5263.) *STERCULIDÆ*. STERCULIACEÆ, *Kunth.*

GEN. RULE. Ib. The calyx being deciduous, the petals often absent, the flowers mostly separate, filaments in general connected into a long antheriferous tube, the albumen fleshy, and the embryo erect and axile. (3680.)

(5264.) *TILIACEÆ*. *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens, discrete or very slightly connate, anthers 2-celled; the ovary superior, several-celled, with 2 or many seeds, occasionally 1-seeded by abortion. The stems arboreous, the leaves alternate and simple, and the stipules deciduous. (3696.)

(5265.) EXCEPTIONS. The petals are sometimes absent, as in *Sloanea* and *Ablania* of the *Tilidæ*.

(5266.) *TILIDÆ*. TILIACEÆ, *Don, Lind.* TILIACEÆ (part of), *Juss.*

GEN. RULE. Ib. The sepals being free and valvate in æstivation, the petals entire and imbricate, the stamens free, and the anthers dehiscent by longitudinal chinks; the seeds many and albuminous. (3699.)

(5267.) EXCEPTIONS. Vide (5265.)

(5268.) *ELÆOCARPIDÆ*.

GEN. RULE. Ib. The sepals free and valvate in æstivation, the petals fringed or serrate, and imbricate, the stamens free, with anthers dehiscent by pores at the apex, the seeds 2 or more in each cell, and albuminous. (3700.)

(5269.) *DIPTEROCARPIDÆ.* DIPTEROCARPEÆ, *Blume.*

GEN. RULE. Ib. The calyx being tubular, unequal, and valvate or imbricate in æstivation, the petals contorted, the stamens indefinite, free or slightly polyadelphous, anthers 2-celled, subulate and dehiscent by pores, the ovary superior, several-celled, and the ovules pendulous in pairs; the fruit invested by the enlarged unequal foliaceous sepals, 1-celled and 1-seeded, and no albumen. (3701.)

CAMELLIANÆ.

(5270.) COLUMNIFERÆ, *β. Lin.* AURANTIA (part of), *Juss.* LAMPROPHYLLÆ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with the sepals and petals imbricate in æstivation, the stamens indefinite and hypogynous, the carpels connate, and the placentæ central; the leaves are simple, alternate, and mostly exstipulate. (3649.)

(5271.) EXCEPTIONS. The leaves are sometimes, though rarely opposite in the *Theaceæ,* and in *Cochlospermum* the dissepiments are imperfect, so that the fruit is 1-celled; stipules are present, but deciduous in *Chlenaceæ.*

(5272.) *CHLENACEÆ, Du Petit Thouars, De Cand.,* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite hypogynous monadelphous stamens, the sepals 3, and imbricate in æstivation, the germen superior, formed of 3-5-connate carpels, with central multiovulate placentæ, the fruit 3-1-celled and 1 or more seeded, the seeds suspended and albuminous, and the embryo green; the leaves simple, alternate, and with deciduous stipules. (3710.)

(5273.) EXCEPTION. The stamens are said to be definite in *Leptolæna.*

(5274.) *THEACEÆ.* TERNSTRÖMIACEÆ, *De Cand.,* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite, hypogynous, mon- or poly-adelphous stamens, the sepals 5 or more, and imbricate in æstivation, the germen superior, formed of several connate carpels, with axial placentæ, the seeds definite, and the albumen 0, or very spare; the leaves simple, alternate, and exstipulate. (3714.)

(5275.) EXCEPTIONS. The fruit in general is plurilocular, but in *Cochlospermum* it is 1-celled, from the dissepiments being arrested in their development.

(5276.) *TERNSTRÖMIDÆ.* TERNSTRÖMIEÆ, *Mirb.,* &c.

GEN. RULE. Ib. The calyx being 5-sepaled and persistent, and albumen sometimes present in small quantity. (3719.)

(5277.) *CAMELLIDÆ.* THEACEÆ, *Mirb.* CAMELLIEÆ, *De Cand.,* &c.

GEN. RULE. Ib. The sepals 5-7 and deciduous, and the seeds exalbuminous. (3720.)

RANUNCULINÆ.

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens; or thalamiflorous Rosales, with the stamens mostly indefinite, the sepals and petals imbricate in æstivation, carpels in general numerous and discrete, albumen mostly large, embryo small, and sometimes vitellose. (3724.)

(5278.) EXCEPTIONS. The stamens and carpels are sometimes definite, and the latter occasionally concrete; the albumen is variable in the *Menispermaceæ.* Petals sometimes absent.

BERBERIANÆ.

(5279.) COCCULINÆ, *Bartl.* MENISPERMA et BERBERIDES, *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with mostly definite hypogynous stamens opposite to the petals, which with the sepals are imbricate and deciduous, the carpels 1 or more, discrete, the fruit baccate or capsular, seeds few or solitary, and albumen variable. (3725.)

(5280.) EXCEPTION. Vide (5282.)

(5281.) *MENISPERMACEÆ, De Cand.* Menisperma, *Juss.* Menispermoideæ, *Vent.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with scandent stems, mostly separated flowers, hypogynous stamens opposite the petals, the anthers dehiscent simply by chinks, and the embryo curved. (3729.)

(5282.) Exception. The flowers are united in *Agdestis;* the corolla is absent in the stamineous flowers of several genera, as *Cissampelos, Schizandra,* &c. De Candolle describes the albumen in these plants as being absent, or very spare; but Arnott says that in several the seeds of which he has examined it is abundant.

(5283.) *BERBERACEÆ.* Berberides, *Juss.* Berberideæ, *Vent.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with non-scandent stems, united flowers, stamens definite, hypogynous and opposite the petals, the anthers dehiscent by recurved valves, the seeds albuminous, and the embryo straight. (3741.)

(5284.) *Obs.* In *Leontice Thalictroides* the seed becomes naked by the arrest of development in the pericarp, which bursts as the seed enlarges.

RANUNCULIANÆ.

(5285.) Multisiliquæ, *Lin.* Polycarpicæ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite hypogynous stamens, the carpels superior, in general numerous, discrete, and multiseriate, the albumen large, the embryo small, and not included in a vitellus. (3726.)

(5286.) Exceptions. The petals are sometimes absent, and frequently indistinguishable from the sepals; occasionally they cohere, as in *Rollinia* of the *Anonaceæ.* The carpels also are sometimes concrete, and at others definite, or even solitary.

(5287.) *ANONACEÆ.* Anonæ, *Juss.* Anonaceæ, *Rich.* Glyptospermæ, *Vent.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with mostly indefinite hypogynous stamens, the carpels superior, in general numerous and distinct, the embryo small, and the albumen ruminated; the leaves are exstipulate. (3748.)

(5288.) Exceptions. The corolla is synpetalous in *Rollinia.* In *Bocagea* the stamens and carpels are definite, and in Monodora there is but a single carpel; occasionally the carpels are not discrete, as in *Anona palustris,* &c.

(5289.) *MAGNOLIACEÆ, De Cand.* Magnoliæ, *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite distinct hypogynous stamens, anthers long, and carpels superior and discrete; the leaves stipulate and the sepals caducous. (3753.)

(5290.) Exceptions. The carpels are solitary in *Tasmannia* of the *Illicidæ;* and the flowers, usually united, are occasionally separated in both subtypes, as in *Tasmannia* above-mentioned, and *Mayna* of the *Magnolidæ.*

(5291.) *MAGNOLIDÆ.* Magnoliæ (part of), *Juss.* Magnoliaceæ (part of), *De Cand.* Magnoliaceæ, *Lind.*

GEN. RULE. Ib. The leaves being impunctate, and the carpels indefinite and spicate: not aromatic. (3761.)

(5292.) *ILLICIDÆ.* Wintereæ, *Brown.* Illicieæ, *De Cand.*

GEN. RULE. Ib. The leaves being pellucido-punctate, and the carpels definite and uniseriate: odoriferous. (3762.)

(5293.) *DILLENIACEÆ, De Cand.* Magnoliis Aff., *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite hypogynous stamens, carpels superior, mostly distinct and definite, the seeds arillate, and the albumen solid; the leaves are sempervirent and exstipulate, and the sepals persistent. (3767.)

(5294.) Exceptions. The carpels occasionally cohere, as in *Dillenia* and *Colbertia*, and sometimes the carpel is solitary. Vide (3770-1.)

(5295.) *RANUNCULACEÆ.* Multisiliquæ, *Lin.* Ranunculi, *Juss.* Anemoneæ, *Guett.* Ranunculaceæ, *De Cand.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite hypogynous stamens and extrorse anthers, the carpels superior discrete, seeds several or many, exarillate, and albumen horny; the leaves are exstipulate, with often dilated petioles, and the perianth deciduous. (3775.)

(5296.) Exceptions. The petals are sometimes absent or indistinguishable from the sepals, as in *Thalictrum, Clematis, Anemone, Hepatica:* the carpels are occasionally more or less coherent, as in *Nigella, Garidella,* &c. The leaves in general are alternate, but in *Clematis, Atragene*, and *Naravella,* they are opposite. (3778.) The sepals are persistent in *Helleborus.*

(5297.) *PÆONIACEÆ.* Ranunculaceæ spuriæ, *De Cand.* Cabombeæ, *Rich.*

GEN. RULE. Apopetalous angiospermous exogenæ, with hypogynous stamens and introrse anthers, superior discrete carpels, and the small embryo lodged in the albumen; the stems are herbaceous, and the leaves exstipulate. (3798.)

(5298.) *PÆONIDÆ.* Ranunculaceæ spuriæ, *De Cand.*

GEN. RULE. Ib. Non-aquatic plants, with deeply-cleft leaves and sheathing petioles. (3801.)

(5299.) *Obs.* The sepals, which are usually deciduous, are persistent in *Pæonia.*

(5300.) *CAMBOMBIDÆ.* Cabombeæ, *Rich.* Podophyllaceæ, *De Cand.*

GEN. RULE. Ib. Marsh or water plants, with broad lobed leaves, and the petioles not sheathing. (3802.)

(5301.) *Obs.* The embryo in these plants has been considered monocotyledonous. This idea, however, originated in error; in their general structure they are decidedly exogenous.

(5302.) *PODOPHYLLEÆ, De Cand.*

GEN. RULE. Ib. Erect marsh plants, not decidedly aquatics, with a single ovary, the stigma thick and subpeltate, and the seeds indefinite. (3809.)

(5303.) *HYDROPELTIDEÆ, De Cand.*

GEN. RULE. Ib. Being aquatic herbs with floating leaves, ovaries 2 or many, and the seeds few, or by abortion solitary. (3810.)

NELUMBIANÆ.

(5304.) Hydrocharides (part of), *Juss.* Nymphæaceæ, *Salisb.*, &c.

GEN. RULE. Apopetalous angiospermous exogenæ, with hypogynous transitional sepals, petals, and stamens, the carpels several and superior, and the embryo enclosed within a persistent vitellus.—Aquatic herbaceous plants, with prostrate stems and simple exstipulate floating leaves. (3727.)

(5305.) *Obs.* The *Nelumbianæ* have, like the *Cabombidæ*, been often considered monocotyledons; indeed, they greatly resemble the *Hydrocharides*, with which Jussieu associated them. The general structure is, however, decidedly exogenous.

(5306.) *NELUMBIACEÆ.* Nelumboneæ, *De Cand.*

GEN. RULE. Ib. The carpels being discrete and simple, and embedded in a fleshy torus; the seeds exalbuminous and the embryo large, with 2 fleshy cotyledons, and a highly developed plumule. (3815.)

(5307.) *NYMPHÆACEÆ, De Cand.*

GEN. RULE. Ib. The carpels being connate, the fruit many-celled and many-seeded, the embryo small, outside the mealy albumen, and the cotyledons foliaceous. (3818.

RHÆADINÆ.

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens, free symmetrical germen, formed of several concrete carpels, with intervalvular and mostly parietal placentæ. (3825.)

(5308.) EXCEPTIONS. The petals are occasionally absent, as in *Bocconia* of the *Papaveraceæ*, and the stamens are subhypogynous in *Eschscholtzia*.

(5309.) *SARRACENNIACEÆ.* SARRACENNIEÆ, *Turp.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite hypogynous discrete stamens, foliaceous peltate stigma, concrete carpels, and indefinite albuminous seeds; the leaves are ascidiate. (3828.)

(5310.) *Obs.* The placentæ project from the axis into the cavities of the cells.

(5311. *PAPAVERACEÆ* (part of), *Juss.*. RHÆADEÆ (part of), *Lin.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous discrete stamens, sepals 2, petals 4, equal (rarely 0), ovary superior, 1-celled, with parietal placentæ; the seeds are albuminous, the juices lactescent, and the cauline leaves alternate. (3831.)

(5312.) EXCEPTIONS. In *Bocconia* the petals are absent, and in *Eschscholtzia* the stamens are subhypogynous, or almost perigynous, from the excavation of the centre of the receptacle and the elevation of its edge.

(5313.) *FUMARIACEÆ, De Cand.* PAPAVERACEÆ (part of), *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons or (*Rosales)*, with definite hypogynous stamens, usually diadelphous, seldom free, the sepals 2 and deciduous, petals 4, cruciate and irregular, the carpels 2 and concrete, the fruit superior, 1-celled, with 2 narrow parietal placentæ, bearing horizontal black shining arillate seeds, with a fleshy albumen. (3843.)

(5314.) *Obs.* The petals are in part coherent, the 2 outer by their ungues, and the 2 inner by their apices.

(5315.) *BRASSICACEÆ.* TETRAPETALÆ SILIQUOSÆ et SILICULOSÆ, *Ray.* CRUCIFORMES, *Tournefort*, SILIQUOSÆ, *Lin.* CRUCIFERÆ, *Juss.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons (or *Rosales)*, with cruciate sepals and petals, hypogynous tetradynamous stamens, parietal placentæ opposite the stigmata, and the seeds without albumen; the leaves are alternate and exstipulate, and the inflorescence for the most part ebracteolate. (3847.)

(5316.) EXCEPTIONS. The petals are occasionally abortive, and sometimes irregular, as in *Iberis*. The æstivation of the calyx is usually imbricate, but, according to Brown, it is valvate in *Savignya* and *Ricotia*. In *Schizopetalon* the embryo has 4 cotyledons.

(5317.) *CAPPARIDACEÆ.* PUTAMINEÆ (part of), *Lin.* CAPPARIDES, *Juss.* CAPPARIDEÆ, *Vent.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens (or *Rhœadosæ)*, the carpels connate, the ovarium unilocular and pedicelled, with 2 narrow parietal intervalvular placentæ, with kidney-shaped exarillate exalbuminous seeds. (3934.)

(5318.) EXCEPTIONS. Petals occasionally absent, as in *Mœrua* and *Thylacium*, and in some species of *Cadaba*, *Niebuhria*, &c., and the stamens are sometimes tetradynamous, as in *Cleome*. The seeds are not always reniform.

(5319.) *RESEDACEÆ, De Cand.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens (or *Rhœadosæ)*, with an open æstivation of the flowers, laciniate petals,

fruit superior, hiant and 1-celled, with 3 parietal polyspermous placentæ, and exarillate reniform exalbuminous seeds. (3946.)

(5320.) EXCEPTION. In *Ochradenus* the petals are degenerate or absent.

(5321.) *POLYGALACEÆ.* POLYGALEÆ, *Juss.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous monadelphous stamens and unsymmetrical flowers, the 5th sepal adaxial, the ovary superior, formed of 2 incumbent carpels, and the seeds solitary, carunculate, and pendulous. (3952.)

(5322.) EXCEPTIONS. The petals are very commonly coherent, and in *Krameria* the stamens are discrete.

(5323.) *Obs.* The sepals are sometimes petaloid, as in several species of *Krameria.* The germen is usually 2-celled, but it occasionally becomes 1-celled by abortion, as in *Mundia, Monnina, Securidaca,* and *Krameria,* in which genera it is also indehiscent.

(5324.) *TREMANDRACEÆ.* TREMANDREÆ, *Brown.*

GEN. RULE. Apopetalous angiospermous dicotyledons (or *Rosales*), with definite discrete hypogynous stamens opposite the petals, which are involute in æstivation, the sepals being valvate, the anthers dehiscent by pores, the carpels 2 and concrete, and the capsule 2-celled, with definite pendulous carunculate seeds, and a loculicidal dehiscence. (3961.)

RUTINÆ.

(5325.) TEREBINTHINÆ (part of), *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens (or *Rhœadosæ),* with balsamic or resinous secretions, leaves mostly punctate and exstipulate, the sepals imbricate in æstivation, the stamens definite, and the layers of the pericarp often separate or easily separable. (3964.)

(5326.) EXCEPTION. The *Ochnaceæ* have not resinous juices.

(5327.) *AMYRIDACEÆ.* TEREBINTHACEÆ (part of), *Juss., De Cand.,* et AMYRIDEÆ, *Kunth,* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, the anthers dehiscent lengthwise by clefts, the fruit subdrupaceous, and the seeds solitary and exalbuminous. The flowers have a quaternary disposition, and the leaves are exstipulate, opposite, compound, and pellucido-punctate. The juices resinous. (3967.)

(5328.) *OLACACEÆ.* OLACINEÆ, *Mirb.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, unsymmetrical flowers, nectariferous petals, bifid or coherent in pairs, and valvate in æstivation, the sepals being imbricate. The ovary is superior, 1-celled, with a free central column or placenta, and 3-ovuled. The fruit is sub-drupaceous and indehiscent, and the seed solitary and exalbuminous. The leaves are alternate, simple, and exstipulate. (3975.)

(5329.) EXCEPTIONS. The ovarium is said by De Candolle to be plurilocular in several genera. In *Ximenia* the petals are all discrete, and hence they lose their cleft appearance.

(5330.) *AURANTIACEÆ.* AURANTIA (part of), *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens and symmetrical flowers. The calyx marcescent, the petals exunguiculate, the ovarium superior, many-celled, the style single, the ovules definite and pendulous, the fruit indehiscent, pulpy, without a ligneous axis, the seeds exalbuminous and chalazous. The leaves are glabrous, pellucido-punctate, alternate, articulate with the petiole, and often compound. (3981.)

(5331.) The leaves are not always dotted, and the petals are sometimes slightly coherent.

(5332.) *RUTACEÆ.* RUTÆ, *Juss.* RUTACEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, gynobasic styles, carpels superior, distinct, or connate; seeds 2 and pendulous, and the embryo straight. (4001.)

(5333.) EXCEPTIONS. The petals are sometimes coherent, and the ovules occasionally erect.

(5334.) *ZYGOPHYLLIDÆ.* ZYGOPHYLLEÆ, *Brown.*

GEN. RULE. Ib. The carpels being connate and dehiscent from the upper angles, and the leaves opposite or alternate, dotless, and exstipulate. (4004.)

(5335.) EXCEPTIONS. The flowers are irregular in *Melianthus.* In *Tribulus* the fruit is separable into spiny nuts, with transverse septa, and seeds without albumen. The ovules also are occasionally erect; and in a New Holland genus the stamens are indefinite and perigynous.

(5336.) *RUTIDÆ.* RUTEÆ, *Ad. de Juss.*

GEN. RULE. Ib. The carpels being often distinct and elastically dehiscent, and the leaves alternate, dotted, and exstipulate. (4005.)

(5337.) *RUTEÆ, Ad. de Juss.*

GEN. RULE. Ib. The flowers being regular, the fruit capsular, and not separating into layers. (4012.)

(5338.) *DIOSMEÆ, Brown,* &c.

GEN. RULE. Ib. The flowers being regular or irregular, and the carpels elastically dehiscent, and the layers of the pericarp separating spontaneously. (4013.)

(5339.) EXCEPTIONS. The petals sometimes are coherent; and in a New Holland genus the stamens are indefinite and perigynous.

(5340.) *ZANTHOXYLEÆ, Nees Von Esenbeck.*

GEN. RULE. Ib. The flowers being regular, but separate, and the carpels discrete or connate. (4014.)

(5341.) *SIMARUBIDÆ.* SIMARUBIÆ, *De Cand.* SIMARUBACEÆ, *Rich.*

GEN. RULE. Ib. (5332.) The carpels being discrete, drupaceous, and indehiscent; and the leaves alternate, dotless, and exstipulate. (4006.)

(5342.) *OCHNACEÆ.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens, regular flowers, a fleshy torus, whorled carpels, a basal style, and solitary seeds: the juices not resinous. (4038.)

(5343.) *OCHNIDÆ.* OCHNACEÆ, *De Cand.*

GEN. RULE. Ib. The flowers having a quinary disposition, the anthers dehiscent by pores, the ovarium deeply lobed, the seeds erect and exalbuminous, and the cotyledons thick. The leaves alternate and stipulate. (4041.)

(5344.) *CASTELIDÆ.*

GEN. RULE. The flowers having a quaternary disposition, the seeds inverted and albuminous, and the cotyledons foliaceous. The leaves are alternate and stipulate. (4042.)

(5345.) *CORIARIDÆ.* CORIARIEÆ, *De Cand.*

GEN. RULE. Ib. The flowers having a quinary disposition, the petals sepaloid, the carpels 5 and distinct, the seeds pendulous and exalbuminous, and the cotyledons fleshy. The leaves are opposite and exstipulate. (4043.)

ACERINÆ.

(5346.) TRIHILATÆ (part of,) *Lin.* ACERA, MALPIGHIÆ, et SAPINDI, *Juss.* MALPIGHINÆ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous, definite (rarely indefinite) stamens, imbricate sepals, hypogynous petals and disk; carpels superior, 2 or more, subconnate or coherent, and the seeds exarillate, and in general without albumen. The leaves are impunctate, and the juices not resinous. (4048.)

(5347.) EXCEPTIONS. The disk is sometimes obsolete, as in *Pittosporidæ*, where the seeds are also albuminous, as well as in the *Erythroxylidæ*. In the *Hippocastanidæ* the cotyledons are conferruminate. In *Sapindaceæ* the petals are occasionally absent, and the leaves are sometimes pellucido-punctate.

(5348.) *SAPINDACEÆ.* SAPINDI, *Juss.* SAPONACEÆ, *Vent.* SAPINDACEÆ, *Juss., De Cand.,* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with distinct, definite, hypogynous stamens, exserted from the disk irregularly, and unsymmetrical polygamous flowers; imbricate and very unequal sepals, mostly appendiculate petals, superior concrete carpels, forming a plurilocular ovarium, with axial placentæ, and becoming a 3-2 or 1-celled fruit, with solitary exalbuminous seeds. (4051.)

(5349.) EXCEPTIONS. The petals are absent in *Dodonæa, Llaguona, Stadmannia,* and occasionally in *Cupania, Nephelium,* &c., and they are without appendages in *Mazonia, Melicocca, Hypelate, Thouinia,* and *Irinia.* In *Tina,* a subgenus of *Cupania,* the flowers are apparently symmetrical.

(5350.) For the characters of the subtypes, see 4054-5-6.

(5351.) *ÆSCULACEÆ.* HIPPOCASTANEÆ et RHIZOBOLEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with hypogynous stamens, or *Rhœadosæ* with arboreous stems, exstipulate compound leaves, irregular flowers, imbricate sepals, exappendiculate petals, carpels several, superior, connate. The seeds exalbuminous, and the embryo large. (4066.)

(5352.) *RHIZOBOLIDÆ.* RHIZOBOLEÆ, *De Cand.*

GEN. RULE. Ib. The stamens indefinite, slightly connate, and arising from the hypogynous disk in a double row. The fruit 4-celled and 4-seeded, separable but not dehiscent; the seed solitary, the radicle large, and the cotyledons small. (4069.)

(5353.) *HIPPOCASTANIDÆ.* HIPPOCASTANEÆ, *De Cand.* CASTANEACEÆ, *Link.*

GEN. RULE. Ib. The stamens definite, distinct, and exserted from the hypogynous disk in a single row. The germen 3-celled, the fruit dehiscent, the seeds large, with a broad hilum, and the cotyledons very large and coherent. (4070.)

(5354.) *ACERACEÆ.* ACERINEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, distinct and exserted from an hypogynous disk. The flowers unsymmetrical, regular, the sepals imbricate in æstivation, the petals entire and exappendiculate, the carpels several and connate, the fruit a 2-celled samara, and the seeds exalbuminous and erect. (4074.)

(5355.) EXCEPTIONS. The petals are sometimes abortive, the flowers are occasionally separate, and the leaves (usually simple) are compound in *Negundium.*

(5356.) *MALPIGHIACEÆ.* MALPIGHIÆ, *Juss.* MALPIGHIACEÆ, *Vent.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, simple leaves, symmetrical flowers, persistent imbricate sepals, carpels 3, superior, connate, and the seeds solitary. (4077.)

(5357.) The petals are wanting in *Aspicarpa* of the *Malpighidæ.*

(5358.) *MALPIGHIDÆ.* MALPIGHIACEÆ, *Lind., Don.* &c.

GEN. RULE. Ib. The petals being unguiculate and without appendages, the disk and styles present, and the seeds without albumen. (4080.)

(5359.) *ERYTHROXYLIDÆ.* Erythroxyleæ, *Kunth.*

GEN. RULE. Ib. The petals dilated and nectariferous, the disk absent, the stigmata sessile, and the seeds with corneous albumen. (4081.)

(5360.) *HIPPOCRATEACEÆ, Kunth.* Hippocraticeæ, *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, coherent by their filaments, and exserted from a cuplike disk, unsymmetrical flowers, the sepals and petals having a quinary, and the stamens a ternary disposition. The sepals are imbricate in æstivation, and the petals entire, exappendiculate, and subimbricate; the carpels superior and connate, the placenta axial, the fruit wingless and indehiscent, and the seeds definite, erect, and exalbuminous.

(5361.) Exceptions. The disposition of the perianth is not always quinary; the sepals and petals are sometimes, though rarely, 4 or 6 in number. (4089.)

(5362.) *BREXIACEÆ.* Pittosporeæ, *Brown*; and Brexiaceæ, *Lind.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite, hypogynous stamens, symmetrical flowers, the sepals and petals imbricate in æstivation, the carpels superior and concrete, the ovarium plurilocular with axial placentæ, and indefinite. The leaves are alternate, simple, and impunctate. (4094.)

(5363.) *PITTOSPORIDÆ.* Pittosporeæ, *Brown.*

GEN. RULE. Ib. The leaves being exstipulate, the disk obsolete, the fruit capsular or baccate, and the seeds albuminous. (4096.)

(5364.) *BREXIDÆ.* Brexiaceæ, *Lind.*

GEN. RULE. Ib. The leaves having minute deciduous stipules, the disk present and staminiferous, the fruit drupaceous, and the seeds without albumen. (4097.)

ANGELICOSÆ.

(5365.) Umbellatæ, &c. *Ray.* Umbellatæ et Hederaceæ, *Lin.* Class XII., &c. *Juss.* Epipetalæ, *Rich.* Umbellifloræ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with epigynous, definite stamens. The fruit wholly inferior, the petals as well as the stamens being exserted from an epigynous disk, and the seeds albuminous.

(5366.) Exception. In the *Loranthinæ* the petals are occasionally connate.

ARALINÆ.

GEN. RULE. Apopetalous angiospermous dicotyledons, with epigynous stamens and petals, the latter broad at the base and valvate in æstivation; the inflorescence umbelliform or cymose, the fruit 2 or more carpelled, concrete, and not separable when ripe. (3367.)

(5367.) Exception. In *Araliaceæ* the petals are sometimes absent.

(5368.) *CORNEACEÆ.* Caprifoliaceæ (part of), *De Cand.* Hederaceæ (part of), *Rich.*

GEN. RULE. Tetrapetalous, tetrandrous, dichlamydeous, angiospermous dicotyledons, with epigynous stamens and petals, the latter broad at the base and valvate in æstivation; a several-celled baccate fruit, the seeds solitary and pendulous, the embryo albuminous, and the radicle short. The leaves are opposite. (3568.)

(5369.) Exception. In *Mastixia* the leaves are alternate.

(5370.) *ARALIACEÆ, Rich.* Araliæ, *Juss.* Hederaceæ, *Lin.*

GEN. RULE. A- or poly-petalous angiospermous dicotyledons, with definite stamens exserted from beneath the margin of a large epigynous disk. The petals broad at the base, and valvate in æstivation. The carpels 2-15, connate, and not separable when ripe. The seeds albuminous, and the radicle long. The leaves are alternate. (3374.)

(5371.) Exception. The flowers in Adoxa are apetalous.

ANGELICINÆ.

(5372.) Umbelliferæ, *Morison.* Umbellatæ, *Ray, Lin., Juss., &c.*

GEN. RULE. Apopetalous, angiospermous, dichlamydeous dicotyledons, the petals narrow at the base and involute, or subimbricate in æstivation; the stamens 5, and exserted from an epigynous disk; the carpels didymous and inferior, each 1-celled; the ovules solitary and pendulous, and the seeds albuminous; the leaves alternate and exstipulate, but furnished with pericladia; and the inflorescence umbellate. (3388.)

(5373.) Exception. The carpel is sometimes, though rarely solitary, perhaps from abortion.

(5374.) *CORIANDRACEÆ.* Cœlospermæ, *De Cand.*

GEN. RULE. Ib. The albumen being curved lengthwise. (3393.)

(5375.) *SMYRNIACEÆ.* Campylospermæ, *De Cand.*

GEN. RULE. Ib. The albumen being curved inwards at its sides. (3392.)

(5376.) *ANGELICACEÆ.* Orthospermæ, *De Cand.*

GEN. RULE. Ib. The albumen being flat or nearly so. (3391.)

LORANTHINÆ.

GEN. RULE. Apo- or synpetalous angiospermous dicotyledons, with definite epigynous stamens opposite the petals, and equal to them in number. The fruit inferior, 1-celled, and the seed solitary, pendulous, and albuminous. (3360.)

(5377.) *LORANTHACEÆ.* Caprifoliaceæ (part of), *Juss.* Loranthеæ, *Rich.*

GEN. RULE. Ib. It may be also added, that the Loranthaceæ have usually a parasitic habit, and their leaves are fleshy and ribless.

MYRTOSÆ.

(5378.) CLASS XIV., *Juss.* Peripetalæ, *Rich.* Calycifloræ (part of), *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens; that is, the stamens and petals are exserted from the calyx or disk.

(5379.) Exceptions. The corolla is sometimes synpetalous and sometimes absent, as in the *Cucurbitinæ, Aquifoliaceæ, Sanguisorbaceæ,* &c., and the stamens are occasionally hypogynous, as in the *Mimosaceæ.*

CUCURBITINÆ.

(5380.) Cucurbitaceæ, *Lin.* Cucurbitaceæ et Cucurb. Aff., *Juss.* Peponiferæ (part of), *Bartl.*

GEN. RULE. Dichlamydeous angiospermous dicotyledons, with mostly separated flowers, perigynous stamens and petals, the latter being discrete or connate, and sometimes indistinguishable from the sepals, or even absent. The germen formed of several connate carpels, and the fruit 1 or more celled, with parietal placentæ. (3320.)

(5381.) *Obs.* The systematic situation of these plants is questionable, as their characters form several exceptions to the general rules of the suborder.

(5382.) *PAPAYACEÆ, Martius.* PAPAYÆ, *Agardh.* CARICEÆ, *Turpin.*

GEN. RULE. Synpetalous angiospermous dicotyledons, with separated regular flowers; a superior germen formed of several carpels, the fruit 1-celled, with parietal polyspermous placentæ, and albuminous seeds. The stems are unbranched and arboreous, and the sap lactescent. (3348-9.)

(5383.) *CUCURBITACEÆ, Lin., Juss.,* &c.

GEN. RULE. Syn- or apo-petalous angiospermous dicotyledons, with definite stamens, often connate, their anthers long and flexuose; the fruit inferior, with parietal placentæ and exalbuminous seeds; the stems are branched, and the sap not lactescent. (3321.)

(5384.) *Obs.* The fruit is usually 1-celled, but the dissepiments often remain entire, and form a plurilocular fruit, as in some species of *Momordica, Neurosperma,* &c. In *Colocynthis* also there is a spurious central cell, formed by the partial recession of the septa.

(5385.) *CUCUMIDÆ.* CUCURBITEÆ, *De Cand.*

GEN. RULE. Ib. The flowers monœcious, diœcious, or united, and the tendrils lateral and stipular.

(5386.) *FEUILLIDÆ.* NANDIRHOBEÆ, *De Cand.*

GEN. RULE. Ib. The flowers being diœcious, and the tendrils axillary and peduncular.

GROSSULINÆ.

GEN. RULE. Apopetalous, angiospermous, perigynous dicotyledons, with united flowers, faucial petals, the germen formed of several connate carpels, the fruit 1-celled, with parietal placentæ, rarely 2-celled, with the placentæ central.

(5387.) EXCEPTIONS. The petals and sepals are sometimes indistinguishable from each other, and occasionally the corolla is absent. (3267.)

(5388.) *LOASACEÆ.* LOASEÆ, *Juss., Kunth,* &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite perigynous stamens, some sterile, the calyx adnate or girding the germen, which is either inferior or superior, formed of several connate carpels; the fruit 1-celled, with parietal placentæ and albuminous seeds. (3316.)

(5389.) *Obs.* The seeds are usually indefinite, but they are definite in *Mentzelia* and *Klaprothia.*

(5390.) *TURNERACEÆ, De Cand.* LOASEÆ (part of), *Humb.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite (5) perigynous stamens, the corolla contorted in æstivation, the capsule superior, 3-valved, 1-celled, with 3 parietal placentæ, and albuminous seeds. (3313.)

(5391.) *PASSIFLORACEÆ.* CUCURBITACEÆ (part of), *Lin.* CUCURB. AFF., *Juss.* PASSIFLOREÆ, *Juss., De Cand.,* &c.

GEN. RULE. Subcorollaceous angiospermous dicotyledons, the pieces of the perianth discrete, but not always distinguishable from each other, and a radiant nectary, the stamens definite and exserted from a stipitiform torus, the carpels connate, forming a superior 1-celled fruit, with parietal placentæ and many seeds, with a scrobiculate albumen. (3299.)

(5392.) EXCEPTIONS. The ovary is subsessile in the *Paropsidæ.*

(5393.) *MALESHERBIDÆ.* MALESHERBIEÆ, *De Cand.* MALESHERBIACEÆ, *Don.*

GEN. RULE. Ib. The petals 5, and convolute in æstivation, the styles long and distant at base, ovarium stipitate, and seeds exarillate; the stems non-scandent and excirrhose.

(5394.) *PASSIFLORIDÆ.* Passifloreæ, *Juss.*

GEN. RULE. Ib. Petals often indeterminable or none, æstivation imbricate, ovarium stipulate, styles close, and seeds arillate, stems often scandent and cirrhose, and the leaves glandular.

(5395.) *PAROPSIDÆ.* Paropsieæ, *De Cand.*

GEN. RULE. Ib. The petals 5 and imbricate, ovary subsessile, and seeds arillate, stems non-scandent and excirrhose.

(5396.) *HOMALIACEÆ.* Homalineæ, *Brown.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with the sepals and petals nearly similar, and glandular scaly nectaries; the stamens perigynous, the germen formed of several connate carpels, inferior or half-superior, 1-celled, with definite parietal placentæ, and albuminous seeds. The leaves are impunctate. (3295.)

(5397.) *SAMYDACEÆ.* Samydeæ, *Gært.*, *Vent.*, &c.

GEN. RULE. Angiospermous dicotyledons, with apetalous flowers, the sepals often petaloid within, the stamens perigynous and monadelphous, the germen free, 1-celled, with definite parietal placentæ, and indefinite ovules. The fruit dehiscent, and the seeds indefinite, arillate, and albuminous. The leaves are pellucido-punctate. (3292.)

(5398.) *GROSSULACEÆ, Mirb.* Pomaceæ (part of), *Lin.* Cacti (part of), *Juss.* Grossularieæ, *De Cand.* Ribesieæ, *A. Rich.*

GEN. RULE. Apopetalous, perigynous, angiospermous dicotyledons, with definite sepals, petals, and stamens; the ovarium inferior and 1-celled, the placentæ parietal, and the seeds many and albuminous. The stems are ligneous and leafy. (3284.)

(5399.) *NOPALACEÆ.* Succulentæ (part of), *Lin.* Cacti (part of), *Juss.* Cactoideæ, *Vent.* Nopaleæ, *De Cand.* Cacteæ, *De Cand.* Opuntiaceæ, *Juss.*

GEN. RULE. Apopetalous, perigynous, angiospermous dicotyledons, with indefinite sepals, petals, and stamens, the carpels several and concrete, the fruit inferior and 1-celled, with many parietal placentæ, and numerous exalbuminous seeds. The stems are fleshy, and in general the foliage is latent. (3270.)

(5400.) Exceptions. In the *Rhipsalidæ* the placentæ are central, and the perianth is distinguishable into calyx and corolla; whereas, in the *Opuntidæ*, the sepals and petals are indistinguishable. In *Pereskia* the stem is scarcely fleshy, and the leaves are well developed.

(5401.) *OPUNTIDÆ.* (3273.)

GEN. RULE. Ib. The placentæ being parietal.

(5402.) *RHIPSALIDÆ.* (3272.)

GEN. RULE. Ib. The placentæ being central.

CRASSULINÆ.

(5403.) Succulentæ, *Lin.*, *Bartl.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, sepals imbricate (rarely valvate) in æstivation, carpels definite, more or less discrete or concrete, but distinct above, placentæ central, seeds albuminous, many (seldom few), and the leaves mostly fleshy or subsucculent. (3207.)

(5404.) Exceptions. The petals are connate in *Fouquieriaceæ*, and some in *Crassulidæ*, and wanting in *Cephalotidæ;* and some *Mesembryanthidæ* and *Portulaceæ*.

(5405.) *FOUQUIERIACEÆ, De Cand.*

GEN. RULE. Synpetalous angiospermous dicotyledons, with definite peri-

gynous stamens, the corolla with a long tube, the carpels connate, the fruit superior, 3-celled, 3-cornered, 3-valved, and dehiscent loculicidally; seeds winged, and the embryo straight, and in the centre of fleshy albumen. (3262.)

(5406.) *PORTULACEÆ* (part of), *Juss.*

GEN. RULE. A- or apopetalous dicotyledons, with definite, irregular, and unsymmetrical perigynous stamens. The carpels connate, the fruit superior and 1-celled, with polyspermous central placentæ, the seeds wingless, and the embryo curved round mealy albumen. (3254.)

(5407.) EXCEPTIONS. The petals are occasionally connate, but their ungues form only a short tube. The seeds are sometimes solitary by abortion.

(5408.) *TELEPHIDÆ.* TELEPHIEÆ, *De Cand.*

GEN. RULE. Ib. The sepals being 5 and connate, the stamens opposite the sepals, the leaves alternate, and the stipules scarious. (3260.)

(5409.) *POLYCARPIDÆ.* POLYCARPYÆ, *De Cand.*

GEN. RULE. Ib. The sepals 5 and connate, the stamens opposite the sepals, the leaves opposite, and the stipules scarious. (3259.)

(5410.) *PORTULIDÆ.* PORTULACEÆ, *De Cand.*

GEN. RULE. Ib. Sepals mostly 2, and the stamens opposite the petals; leaves opposite or alternate, and stipules 0 or membranaceous. (3258.)

(5411.) EXCEPTIONS. In *Leptrina, Hydropydis, Ginginsia, Colobanthus, Lewisia, Cypexlea,* and *Trianthema,* the calyx is formed of more than 2 sepals.

(5412.) *MESEMBRACEÆ.* SUCCULENTÆ (part of), *De Cand.* FICOIDEÆ, *Juss.*

GEN. RULE. A- or polypetalous dicotyledons, with perigynous stamens, (in general numerous, 5 or more,) the carpels connate, and seeds for the most part numerous, with a curved, spiral, or straight embryo. (3245.)

(5413.) *REAUMURIDÆ.* FICOIDEÆ SPURIÆ (part of), *De Cand.* REAUMURIEÆ, *Ehrenberg.*

GEN. RULE. Ib. The petals 5, stamens hypogynous (?), ovarium superior, albumen mealy, embryo straight; the leaves alternate, small, and scale-like. (3250.)

(5414.) *NITRARIDÆ.* FICOIDEÆ SPURIÆ (part of), *De Cand.* NITRARIACEÆ, *Lind.*

GEN. RULE. Ib. The petals 5, stamens perigynous, ovary superior, seeds exalbuminous, and embryo straight; the leaves are alternate. (3249.)

(5415.) *MESEMBRYANTHIDÆ.* FICOIDEÆ VERÆ, *De Cand.*, &c.

GEN. RULE. Petals 0 or many, usually indefinite, ovarium inferior, seeds albuminous, and embryo curved or spiral; the leaves opposite. (3248.)

(5416.) *Sesuvium, Aizoon, Tetragonia,* and *Miltus,* have apetalous flowers. In the two latter the seeds are definite.

(5417.) *CRASSULACEÆ.* SUCCULENTÆ (part of), *Lin.* SEMPERVIVÆ, *Juss.* CRASSULACEÆ, *De Cand.*

GEN. RULE. A- or polypetalous angiospermous dicotyledons, the petals sometimes coherent, the stamens definite and perigynous, the carpels several and superior, seeds variable in number, embryo straight, and radicle hilose. (3235.)

(5418.) EXCEPTIONS. The petals and stamens are sometimes almost hypogynous.

(5419.) *CRASSULIDÆ.* CRASSULACEÆ, *De Cand.*, &c.

GEN. RULE. Ib. The corolla often catapetalous, stamina irregular, carpels mostly discrete, styles terminal, seeds in general indefinite, and albumen fleshy. All except *Penthorum* succulent. (3239.)

(5420.) *Obs.* In *Diamorpha* and *Penthorum*, the *Crassulaceæ Anomalæ* of *Don*, the ovaria are concrete; the latter also is not succulent: the ovules are definite in *Tillæa*.

(5421.) *CEPHALOTIDÆ.* Cephaloteæ, *Brown*.

GEN. RULE. Ib. The flowers being apetalous, the stamens alternately longer and shorter, the styles terminal, the carpels discrete and 1-2-seeded, albumen friable, and the leaves ascidiate. (3238.)

(5422.) *GALACIDÆ.* Galacineæ, *Don*.

GEN. RULE. Ib. The corolla being apopetalous, the stamens alternately barren and fertile, style 0, carpels superior, concrete, capsule 3-4-celled and many-seeded. (3237.)

(5423.) *SAXIFRAGACEÆ.* Saxifragæ, *Juss.* Saxifrageæ, *De Cand.* and *Duby*.

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, sepals few and imbricate in æstivation, the carpels more or less adherent to each other, and the calyx rarely discrete, seeds many, embryo straight, and radicle short and hilose. (3225.)

(5424.) Exceptions. Petals sometimes absent and sometimes connate. Vide *Escallonidæ* and *Cunonidæ*.

(5425.) *SAXIFRAGIDÆ.* Saxifrageæ, *Lind.* Do. (part of), *De Cand.*

GEN. RULE. Ib. The stamens definite and dehiscent by chinks, and the capsules 2-celled.—Herbaceous plants, with opposite, rarely alternate exstipulate leaves. (3230.)

(5426.) Exceptions. Petals absent in *Chrysosplenium*.

(5427.) *HEUCHERIDÆ.*

GEN. RULE. Ib. The stamens definite, anthers dehiscent by chinks, and the capsule 1-celled. (3231.)

(5428.) Exceptions. In Heuchera the flowers are irregular, and sometimes apetalous.

(5429.) *BAUERIDÆ.* Cunoniaceæ (part of), *Brown.* Baueraceæ, *Lind.*

GEN. RULE. Ib. The stamens indefinite, anthers dehiscent by pores, and the capsule 2-celled, opening at the apex between the styles.—Shrubs, with opposite exstipulate, compound leaves. (3229.)

(5430.) *CUNONIDÆ.* Cunoniaceæ, *Lind.* Do. (part of), *Brown.*

GEN. RULE. Ib. The stamens definite, carpels 2, connate or discrete, 2 or many seeds, and a- or apopetalous flowers.—Trees or shrubs, with opposite leaves and interpetiolar stipules. (3226.)

(5431.) Exception. Flowers occasionally apetalous.

(5432.) *ESCALLONIDÆ.* Escallonieæ, *Brown*, &c.

GEN. RULE. Ib. The flowers being synpetalous, the carpels concrete, and the seeds indefinite.—Trees or shrubs, with alternate, simple, exstipulate leaves. (3227.)

(5433.) *HAMAMELIACEÆ.* Hamamelideæ, *Brown.*

GEN. RULE. A- or apopetalous angiospermous dicotyledons, with definite perigynous stamens; the ovarium formed of 2 connate carpels, inferior or half-inferior, and solitary pendulous albuminous seeds.

(5434.) *HAMAMELIDÆ.* Hamameleæ, *Don.*

GEN. RULE. Ib. The flowers tetrapetalous, with an involuto-valvate æstivation, stamens (8), double their number, 4 barren and 4 fertile, and the anthers dehiscent by deciduous valves. (3221.)

(5435.) *FOTHERGILLIDÆ.* FOTHERGILLEÆ, *Don.*

GEN. RULE. Ib. The flowers apetalous, the stamens (24,) all fertile, and the anthers dehiscent by chinks. (3222.)

(5436.) *HYDRANGEACEÆ.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, sepals valvate, and petals imbricate in æstivation; the carpels connate, inferior or half-inferior, the seeds indefinite, albuminous, with straight superior radicles. (3210.)

(5437.) *HYDRANGIDÆ.* HYDRANGEÆ, *De Cand.*, &c.

GEN. RULE. Ib. The stamens few, seeds exarillate, testæ reticulate.

(5438.) *PHILADELPHIDÆ.* PHILADELPHEÆ, *De Cand.*

GEN. RULE. Stamens many, seeds arillate, testæ smooth.

ONAGRINÆ.

(5439.) CALYCANTHEMÆ (part of), *Lin.* ONAGRÆ, *Juss.* CALYCIFLORÆ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, the sepals valvate in æstivation, the germen symmetrical, 1-4-celled, inferior (seldom free), seeds albuminous or subalbuminous, rarely without albumen, and the embryo straight; the leaves simple and exstipulate, mostly opposite.

(5440.) EXCEPTIONS. The sepals are imbricate in the *Vochyaceæ*. In the *Lythraceæ* the germen is free, and in the *Rhizophoraceæ* it is half-inferior.

(5441.) *CIRCÆACEÆ, Lind.* ONAGRARIEÆ (part of), *De Cand.*

GEN. RULE. Dichlamydeous angiospermous dicotyledons, with disepalous, dipetalous, and diandrous flowers, an inferior 2-celled, 2-valved, 2-seeded fruit, each cell having a solitary, erect, exalbuminous seed, with an erect embryo.

(5442.) *ONAGRACEÆ.* ONAGRÆ (part of), *Juss.* EPILOBIACEÆ, *Vent.* ONAGRARIEÆ, *Juss.*, *De Cand.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, 4 valvate sepals, 4-10 contorted petals, inferior 2-4-celled germen, central placentæ, and indefinite exalbuminous seeds. (3193.)

NOTE. For the characters of the subtypes, vide § 3196, 3197, 3198, 3199, 3200.

(5443.) *LYTHRACEÆ.* SALICARIEÆ, *vel* LYTHRARIEÆ, *Juss.* CALYCANTHEMÆ, *Vent.* SALICARINÆ, *Link.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, calyx tubular, limb shortly toothed, germen free, and the fruit superior, invested by the calyx, plurilocular, with central placentæ, and numerous exalbuminous seeds. (3181.)

(5444.) *LAGERSTROEMIDÆ.* LAGERSTRÖMIEÆ, *De Cand.*

GEN. RULE. Ib. The sepals exactly valvate in æstivation, petals always present, and the seed-coat expanded into a membranous wing. (3185.)

(5445.) *LYTHRIDÆ.* SALICARIEÆ, *De Cand.*

GEN. RULE. Ib. The sepals distant, or only subvalvate in æstivation; the petals occasionally absent, and the seeds apterous. (3184.)

(5446.) *RHIZOPHORACEÆ.* CAPRIFOLIA (part of), *Juss.* RHIZOPHOREÆ, *Brown.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, sepals connate and valvate in æstivation, germen inferior or half-inferior, 2-celled and 2-ovuled, the fruit 1-celled, with 1 pendulous seed; the leaves are opposite, with intrafoliaceous stipules.

(5447.) EXCEPTION. Vide *Cassipouridæ*.

(5448.) *CASSIPOUIDÆ.* RHIZOPHOREÆ SPURIÆ, *De Cand.*

GEN. RULE. Ib. The calyx being free, the germen superior, and the seeds albuminous. (3176.)

(5449.) *RHIZOPHORIDÆ.* RHIZOPHOREÆ VERÆ, *De Cand.*

GEN. RULE. Ib. The calyx more or less adherent, germen inferior, and the seeds without albumen. (3171.)

(5450.) *VOCHYACEÆ, Lind.* VOCHYSIACEÆ, *Mart.* VOCHYSIEÆ, *Augt. St. Hil.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, irregular flowers, the calyx spurred and imbricate in æstivation, the petals and stamens variable in size and number, (1, 2, 3, 4, 5,) the carpels concrete, superior or inferior, the seeds exalbuminous and often winged, and the embryo straight and inverted. (3166.)

(5451.) *Obs.* The leaves, which are usually furnished with stipules, are exstipulate in *Salvertia*.

(5452.) *COMBRETACEÆ.* ONAGRÆ (part of), *Juss.* COMBRETEÆ ET ALANGIEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, perigynous stamens, with regular flowers, sepals valvate in æstivation, an inferior 1-celled ovarium, and definite pendulous seeds; the leaves are simple, exstipulate, and impunctate. (3158.)

(5453.) *COMBRETIDÆ.* COMBRETEÆ, *De Cand.*

GEN. RULE. Ib. The petals oblong, 4-5, the anthers terminal, the seeds exalbuminous, and the cotyledons convolute or plicate. (3162.)

(5454.) *ALANGIDÆ.* ALANGIEÆ, *De Cand.*

GEN. RULE. Ib. The petals linear, 6-10, the anthers adnate, the seeds albuminous, and the cotyledons flat (ovato-cordate). (3161.)

MYRTINÆ.

(5455.) HESPERIDEÆ, *Lin.* MYRTI ET MELASTOMÆ, *Juss.*

GEN. RULE. Apopetalous angiospermous exogenæ, with perigynous stamens, or *Myrtosæ* having simple exstipulate leaves, sepals imbricate, rarely valvate in æstivation, the flowers regular and united, the carpels usually concrete, inferior (seldom free), seeds exalbuminous, and cotyledons often joined. (3084.)

(5456.) EXCEPTIONS. Petals sometimes absent, as in two species of *Sonneratia*, viz. *alba* and *apetala*.

(5457.) *MELASTOMACEÆ, Don.* MELASTOMÆ, *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, long inflexed anthers, a plurilocular ovarium, inferior or occasionally half-inferior, and indefinite exalbuminous seeds, with equal or unequal cotyledons; the leaves are simple, opposite, exstipulate, 3 or more ribbed, and impunctate. (3148.)

(5458.) EXCEPTIONS. The ribs occasionally obscure or absent, as in *Sonerila*; and traces of pellucid dots are found in *Diplogena*.

(5459.) *MELASTOMIDÆ.* MELASTOMEÆ, *De Cand.*

GEN. RULE. The anthers dehiscent by apicial pores. (3152.)

(5460.) *CHARIANTHIDÆ.* CHARIANTHEÆ, *De Cand.*

GEN. RULE. Ib. The anthers dehiscent lengthwise by chinks.

(5461.) *MEMECYLACEÆ.* MEMECYLEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, long incurved anthers, an inferior plurilocular ovarium, definite pendulous exalbuminous seeds and convolute cotyledons; the leaves are opposite, exstipulate, 1-ribbed, and impunctate.

(5462.) *GUSTAVIACEÆ.* Myrti (part of), *Juss.*, *De Cand.*, &c. Barringtonieæ et Lecythideæ, *Bartl.*, *Don*, *Lind.*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite perigynous stamens, concrete carpella, inferior plurilocular fruit, and the seeds several and exalbuminous; the leaves are alternate and impunctate. (3130.)

(5463.) *LECYTHIDÆ.* Lecythideæ, *Rich.*, *De Cand.*, &c.

GEN. RULE. Ib. The corolla being often catapetalous, the stamens often connate or submonadelphous, the fruit a woody capsule, dehiscent transversely: the cotyledons are foliaceous, and the leaves have small deciduous stipules. (3134.)

(5464.) *BARRINGTONIDÆ.* Barringtonieæ, *De Cand.*, &c.

GEN. RULE. Ib. The petals discrete, the fruit indehiscent, the cotyledons large and fleshy, and the leaves exstipulate, with intromarginal costules. (3183.)

(5465.) *MYRTACEÆ, Brown.* Myrtineæ, *De Cand.* Myrtoideæ, *Vent.* Myrteæ, Myrti, *Juss.*

GEN. RULE. Apopetalous angiospermous exogenæ, with indefinite perigynous stamens and small anthers, an inferior ovarium, and exalbuminous (mostly indefinite) seeds; the leaves opposite, exstipulate, aromatic, pellucido-punctate, and with intromarginal costules. (3098.)

(5466.) *Obs.* The sepals and petals often cohere by their upper edges, and separate in the form of calyptræ; the cotyledons are frequently conferruminate.

(5467.) *MYRTIDÆ.* Myrteæ, *De Cand.*

GEN. RULE. Ib. The stamens free, and the fruit fleshy and many-celled. (3102.)

(5468.) *LEPTOSPERMIDÆ.* Leptospermeæ, *De Cand.*

GEN. RULE. Ib. The stamens free or polyadelphous, the fruit dry and many-celled. (3101.)

(5469.) *CHAMÆLAUCIDÆ.* Chamælaucieæ, *De Cand.*

GEN. RULE. Ib. The stamens free or subpolyadelphous, and the fruit dry and 1-celled. (3100.)

(5470.) *PUNICACEÆ.* Pomaceæ (part of), *Lin.* Myrti (part of), *Juss.* Granateæ et Calycantheæ, *Don*, &c. Calycanthinæ, *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, urceolate persistent calyx, many carpels, and seeds without albumen; the leaves simple, exstipulate, and dotless.

(5471.) *GRANATIDÆ.* Granateæ, *Don.* Myrtaceæ (part of), *Auct.*

GEN. RULE. Ib. The sepals valvate, the stamens indefinite, the anthers introrse, the carpels connate, and the fruit a balaust; the stem uniaxial, branches spiny, leaves smooth and subpunctate. (3090.)

(5472.) *CALYCANTHIDÆ.* Monimiis Aff., *Juss.* Rosaceis Aff., *Nees von Esenbeck.* Calycantheæ, *Lind.*

GEN. RULE. Ib. The sepals imbricate and indistinguishable from the petals, stamens subindefinite, anthers extrorse, carpels free and monospermous, fruit a cynarhodon; the stem multiaxial, spines 0, leaves scabrous and impunctate. (3089.)

ROSINÆ.

(5473.) *SYN.* POMIFERÆ, PRUNIFERÆ, &c., *Ray.* SENTICOSÆ ET POMACEÆ, *Lin.* ROSACEÆ, *Juss.* CALOPHYTÆ (part of), *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, a pentasepalous calyx, the 5th or odd sepal being posterior or axial; the fruit a drupe, pome, follicle, or akenium (not a legume), the seeds exalbuminous, and the embryo straight; the leaves stipulate. (2248.)

(5474.) EXCEPTIONS. Petals occasionally absent, as in *Sanguisorbaceæ* and *Hirtella apetala* of the *Chrysobalanidæ*, and *Rubus apetalus* of the *Rosaceæ:* the stipules are occasionally wanting, as in *Rosa Lowea ;* sometimes converted into leaves, as in *R. bracteata ;* and at others obsolete, as in many species of *Spiræa*, the *Hirtellæ*, and in the abnormal genus *Neillia :* embryo curved in *Neurada*.

(5475.) *SANGUISORBACEÆ.* SANGUISORBÆ (part of *Rosaceæ*), *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, the calyx persistent and indurated, inclosing a solitary dry carpel (akenium) ; the leaves alternate and stipulate. (3077.)

(5476.) *Obs.* The anthers, usually 2-celled and dehiscent lengthwise, are 1-celled and dehiscent transversely in *Alchemilla arvensis ;* and in this plant, the ovules, in general suspended, are said to be ascending. In the *Cliffortiæ* the stipules adhere to the petioles. *Florkea*, if referred to this group, is an abnormal genus. (3554.)

(5477.) *SPIRÆACEÆ, De Cand.* SPIREÆ (part of *Rosaceæ*), *Juss.*, &c. ULMARIEÆ, *Vent.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, fruit superior, follicular, styles terminal, seeds several and exalbuminous. The calyx ebracteate, the leaves mostly stipulate. (3065.)

(5478.) *QUILLAJIDÆ.* QUILLAJEÆ, *Don.*

GEN. RULE. Ib. With arborescent stems, caducous stipules, valvate sepals, diœcious flowers, spreading follicles, connate below, erect ovules, and leafy cotyledons. (3069.)

(5479.) EXCEPTION. Petals wanting in *Kageneckia*.

(5480.) *SPIRÆIDÆ.* SPIREÆ, *Juss.* ULMARIEÆ, *Vent.*

GEN. RULE. Ib. Herbs or shrubs, with imbricate sepals, united flowers, discrete follicles, suspended ovules, and thickish cotyledons. (3068.)

(5481.) EXCEPTIONS. In *Schizonotus sorbifolia* the carpels cohere, and form a capsular fruit.

(5482.) *ROSACEÆ, De Cand.* SENTICOSÆ, *Lin.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, the fifth sepal posterior or axial, the carpels superior, the seeds definite and exalbuminous, and the fruit akenia or drupeolæ ; leaves alternate and stipulate.

(5483.) EXCEPTIONS. *Neurada* has a half-adherent calyx, connate carpels, and a plurilocular capsular fruit; stipules absent in *Rosa Lowea*, and occasionally in *Rosa bracteata*. (3033.)

(5484.) *NEURIDÆ.* NEURADEÆ, *De Cand.*

GEN. RULE. Ib. The calyx valvate in æstivation, and partially adherent to the germen; the stamens definite, the carpels connate, forming a 10-celled capsule, and the embryo curved. (3038.)

(5485.) *ROSIDÆ.* ROSÆ, *Juss.* ROSEÆ, *De Cand.*

GEN. RULE. Ib. The calyx urceolate, and the lobes spirally imbricate in æstivation, stamens indefinite ; the fruit a cynarhodon, and the embryo straight. (3037.)

(5486.) *FRAGRARIDÆ.* POTENTILLÆ, *Juss.* DRYADEÆ, *Vent.* FRAGARIACEÆ, *Rich.*

GEN. RULE. Ib. The sepals valvate, the carpels numerous and free, the fruit either akenia or drupeolæ, surrounded by the permanent calyx; the embryo straight. (3036.)

(5487.) *PYRACEÆ.* Pomiferæ, *Ray.* Pomaceæ (part of), *Lin.* Do. *Juss.*, *De Cand.*, &c.
GEN. RULE. Apopetalous angiospermous dicotyledons, with numerous perigynous stamens, carpels invested by a more or less adherent calyx, the fifth sepal of which is axial, the fruit pomaceous, the ovules definite and collateral, the seeds without albumen, and the embryo straight; the leaves are alternate and stipulate.

(5488.) Exceptions. *Dicalyx* and *Pyrenaria*, vide *Dicalycidæ* and *Pyrenaridæ*.

(5489.) *PYRENARIDÆ.*
GEN. RULE. Ib. The calyx being inferior, the stamens subperigynous, the fruit superior and subpomaceous; the embryo erect, and the cotyledons twisted. (3006.)

(5490.) *DICALYCIDÆ.*
GEN. RULE. Ib. The corolla catapetalous, the ovary inferior, 3-celled, and many-ovuled, the fruit subdrupaceous, the seeds pendulous, albuminous, and by abortion solitary; the embryo inverted and slightly curved. (3004.)

(5491.) *PYRIDÆ.*
GEN. RULE. Ib. The fruit a pome, the seeds solitary, ascending, and exalbuminous; the embryo erect and straight.

(5492.) Exceptions. The carpels are sometimes (but very seldom) solitary in *Cratægus;* and in *Amelanchier* they are spuriously 2-celled.

(5493.) *PRUNACEÆ.* Pruniferæ, *Ray.* Pomaceæ, *Lin.* Amygdaleæ, *Juss.*, &c. Drupaceæ, *De Cand.*
GEN. RULE. Apopetalous angiospermous dicotyledons, with numerous perigynous stamens, the 5th sepal of the calyx posterior, the carpels free and superior, and the fruit drupaceous; the seeds exalbuminous, and the leaves alternate, simple, and stipulate.

(5494.) Exception. Vide (5497.)

(5495.) *AMYGDALIDÆ.* Amygdaleæ, *Auct.*
GEN. RULE. Ib. The calyx being deciduous, the petals regular, stamens equal, the styles terminal, the seeds pendulous, and the radicle superior.

(5496.) *CHRYSOBALANIDÆ.* Chrysobalaneæ, *Brown.*
GEN. RULE. Ib. The calyx being persistent and coherent at one side with the germen, the petals often irregular or absent, the style basal, and the seeds erect.

(5497.) Exception. The seeds are albuminous in the *Hirtellæ*.

CICERINÆ.

(5498.) Leguminosæ, *Ray, Juss.*, &c. Papilionaceæ et Lomentaceæ, *Lin.*
GEN. RULE. Apopetalous angiospermous dicotyledons, with indefinite perigynous (seldom hypogynous) stamens, superior simple ovaria with terminal styles, the fruit a legume or loment, very rarely a drupe, the seeds definite and exalbuminous, the fifth sepal abaxial, and the leaves alternate and stipulate.

(5499.) Exceptions. The petals are occasionally reduced in number from 5 to 4, 3, 2, 1. or are altogether absent, as in the *Detariaceæ*, &c. Sometimes they are connate, as in the *Mimosaceæ*, in which group the stamens are mostly hypogynous, and occasionally indefinite. The *Swartziaceæ* also are sometimes apetalous, and have hypogynous stamens. The leaves are rarely opposite, and occasionally exstipulate, as in the *Connaraceæ*, the *Sophoræ*, and the *Myrosperma*.

Obs. In *Moringa* the carpels are 3 and connate, forming a 3-valved capsular fruit: and hence by Brown it has been made the typical genus of a separate group, which he has named *Moringeæ*. (2187.)

(5500.) Note. For definitions of the *Leguminosæ*, *Papilionaceæ*, and *Lomentaceæ* of authors, vide § 2025 and 2026.

MIMOSIANÆ.

(5501.) LEGUMINOSÆ (part of), *Ray*, *Juss.*, &c. LOMENTACEÆ (nearly), *Lin.* LEG. RECTEMBRIEÆ, *De Cand.*

GEN. RULE. Ib. The embryo straight and the radicle hilose.

(5502.) *DETARIACEÆ.* DETARIEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with subdefinite perigynous stamens, the calyx 4-lobed and valvate in æstivation, the fruit superior and drupaceous; the seeds solitary and exalbuminous, the embryo straight, and the radicle hilose. (2240.)

(5503.) *MIMOSACEÆ.* MIMOSEÆ, *De Cand.*

GEN. RULE. Dichlamydeous angiospermous dicotyledons, with definite or indefinite hypogynous stamens, sepals 4-5, valvate in æstivation, petals free or connate, equal, valvate, fruit superior, a legume or loment, with definite exalbuminous seeds, a straight embryo and hilose radicle. The leaves are alternate and pinnate, the stipules free and often spiny. (2220.)

(5504.) *Obs.* The leaves frequently degenerate into *Phyllodia*. In *Erythrophleum* the stamens are perigynous.

(5505.) *CASSIACEÆ.* CÆSALPINIEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, the sepals and petals imbricate in æstivation, the fruit superior, a legume or loment, and the seeds definite and exalbuminous, with a straight embryo and hilose radicle; the leaves alternate and stipulate. (2173.)

(5506.) *CÆSALPINIDÆ.* CASSIEÆ, *De Cand.*

GEN. RULE. Ib. The stamens free, and the corolla not papilionaceous. (2177.)

(5507.) EXCEPTIONS. In *Copaiferea*, *Dialium*, *Jonesia*, *Hardwickia*, and *Ceratonia*, the flowers are apetalous. In *Afzelia*, *Palovea*, *Tamarindus*, and *Heterostemon*, the petals vary from 4 to 3 and 2; and in *Eperua*, *Parivoa*, *Codarium*, *Intsia*, *Vouapa*, and *Anthonota*, 1 only is developed; while in *Reichardia* there are from 6 to 10. *Moringa* has a 3-valved fruit, vide (5499.)

(5508.) *GEOFFROYIDÆ.* GEOFFROIEÆ, *De Cand.*

GEN. RULE. Ib. The stamens connate by their filaments, and the corolla papilionaceous. (2176.)

LOTIANÆ.

(5509.) *SYN.* PAPILIONACEÆ, *Lin.* (nearly). LEGUMINOSÆ (part of), *Ray*, *Juss.*, &c. LEGUM. CURVEMBRIÆ, *De Cand.*

GEN. RULE. Ib. (5498.) The embryo being curved, and the radicle hilose.

(5510.) *SWARTZIACEÆ.* SWARTZIEÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite hypogynous stamens, the sepals connate, lobes indistinct but valvate in æstivation, the petals irregular in number (mostly 1 or 2), sometimes absent, the fruit superior, a legume, the seeds definite and exalbuminous, the embryo curved, and the radicle hilose. The leaves alternate, pinnate, and stipulate. (2164.)

(5511.) *LATHYRACEÆ.* LEG. CURVEMBRIÆ SARCOLOBÆ, *De Cand.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous mon- or di-adelphous stamens, the sepals unequal, imbricate in æstivation, and the fifth anterior, the corolla papilionaceous, the fruit superior, a legume or loment, with definite exalbuminous seeds; the embryo curved, the radicle hilose, and the seed-lobes fleshy and often hypogean. (2111.)

(5512.) *Obs.* In *Lathyrus Aphaca* the leaves are abortive, and their place supplied by enlarged stipules; while in *Lathyrus Nissolia* the leaves degenerate into *Phyllodia*, and the stipules are small, or even absent.

(5513.) *LOTACEÆ.* LEG. CURVEMBRIÆ PHYLLOLOBEÆ, *De Cand.*

GEN. RULE. Ib. (5511.) The seed-lobes being foliaceous and epigean. (2035.)

(5514.) *Obs.* In *Diphaca* there are 2 carpels, a peculiarity which also occurs in *Cæsalpinia Digyna* and a Brazilian species of *Mimosa*, &c. In *Ormosia* the style is crowned by 2 approximate stigmata, and in *Moringa* of the *Cæsalpinidæ* the fruit is formed of 3 connate carpels. See 5507. The stipules are absent in *Sophora* and *Myrospermum*.

CONNARIANÆ.

(5515.) TEREBINTACEÆ (part of), *Juss.* CONNARACEÆ, *Brown.*

GEN. RULE. Ib. (5498.) The embryo being straight and the radicle abhilose. (2020.)

(5516.) *CONNARACEÆ, Brown*, &c.

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite subperigynous stamens, sepals imbricate or valvate in æstivation, filaments usually monadelphous, carpels superior, solitary or several, and leguminous, seeds few and exalbuminous, the embryo straight, and the radicle abhilose. The leaves alternate, compound, impunctate, and without stipules. (2027.)

(5517.) EXCEPTION. Albumen is sometimes present in the seeds.

TEREBINTHINÆ.

(5518.) *SYN.* TEREBINTACEÆ, *Juss.* TEREBINTHINÆ (part of), *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, imbricate sepals, the carpels few and superior, the seeds exalbuminous, and the radicle turned towards the hilum. The leaves exstipulate and impunctate, and the juices mostly resinous. (1968.)

(5519.) EXCEPTIONS. In *Melanorhœa* of the *Cassuviaceæ* the stamens are indefinite and hypogynous, and in an unpublished genus (believed to be referrible to the same type) the germen is said by Dr. Brown to be superior.

(5520.) *BURSERACEÆ, Kunth.* TEREBINTACEÆ (part of), *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, twice or four times as many as the petals, which are usually valvate, while the sepals are imbricate in æstivation; the disk is orbicular or annular, the carpels superior, several, and concrete, the fruit drupaceous, 2-5-celled, the ovules 2 in each cell, and collateral, the seeds exalbuminous, and the radicle hilose. The leaves alternate, pinnate, and impunctate. (2002.)

(5521.) *Obs.* Stipules are sometimes present, and at others absent; traces of pellucid dots are occasionally found.

(5522.) *SPONDIACEÆ, Kunth.* TEREBINTACEÆ (part of), *Juss.* TRICOCCÆ (part of), *Bartl.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, a large annular disk, and superior concrete carpels; the fruit drupaceous, 2-5-celled, the seeds solitary, pendulous, and exalbuminous. The leaves are alternate, exstipulate, and dotless, and the juices not resinous. (1097.)

(5523.) *CASSUVIACEÆ.* TEREBINTACEÆ (part of), *Juss.* CASSUVIEÆ et ANACARDIEÆ, *Brown.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with perigynous stamens, an enlarged torus, and usually single superior carpels; the fruit is simple and drupaceous, and the seed solitary, pendulous, and exalbuminous. The leaves alternate, exstipulate, and impunctate, and the juices resinous.

(5524.) EXCEPTIONS. The carpels are sometimes several, but all save one are abortive. (See also § 5519.)

(5525.) *SUMACHIDÆ.* SUMACHINEÆ, *De Cand.*

GEN. RULE. Ib. The seed-lobes foliaceous, and radicle folded back on the edges of the cotyledons.

(5526.) *PISTACIDÆ.* ANACARDIEÆ, *De Cand.*

GEN. RULE. Ib. The seed-lobes being thick and fleshy, and the cotyledons folded back on the radicle.

ILICINÆ.

(5527). *SYN.* Dumosæ (part of), *Lin.* Rhamni, *Juss.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, sepals imbricate, rarely valvate in æstivation; the carpels few, the seeds albuminous, and the embryo straight. (1919.)

(5528.) Exceptions. The staminiferous corolla of the *Aquifolidæ* is hypogynous and catapetalous, and in *Rhamnaceæ* and *Celastridæ* it is occasionally absent. Albumen sometimes, but rarely wanting, as in the *Staphylidæ.*

(5529.) *RHAMNACEÆ.* Rhamneæ, *De Cand.*

GEN. RULE. A- or apopetalous angiospermous dicotyledons, with definite perigynous stamens, opposite the petals (when present), or alternate with the sepals, which are valvate in æstivation. The germen inferior or superior, 2-3-4 celled, and the seeds solitary and erect; the albumen mostly present, but sometimes very spare. The leaves simple, alternate, and stipulate. (1951.)

(5530.) Exceptions. The minute stipulæ are often absent, and the leaves are sometimes opposite.

(5531.) *BRUNIACEÆ, Brown.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens, alternate with the petals; sepals and petals imbricate in æstivation; germen half-superior, formed of 1 or several carpels; ovules definite and pendulous, seeds solitary or in pairs, and the embryo in the axis of fleshy albumen.

(5532.) Exceptions. The germen is superior in *Raspailia.*

(5533.) *CELASTRACEÆ.* Rhamni (part of), *Juss.* Celastrineæ, *Brown.*

GEN. RULE. Apopetalous angiospermous dicotyledons, with definite perigynous stamens opposite to the sepals, which with the petals are imbricate in æstivation; the disk staminiferous, the carpels several, superior, and the seeds definite, erect, or ascending, and in general albuminous.

(5534.) Exceptions. Vide *Staphylidæ* and *Dulongidæ.*

(5535.) *STAPHYLIDÆ.* Staphyleaceæ (part of). Celastrineæ, *De Cand.*

GEN. RULE. Ib. The seeds being osseous, truncate, exarillate, and exalbuminous, and the leaves compound, opposite, and stipulate. (1936.)

(5536.) *CELASTRIDÆ.* Celastrineæ, *Lind.* Do. (part of), *De Cand.*

GEN. RULE. Ib. The seeds not truncate, arillate, the albumen fleshy, and the leaves simple, alternate, and exstipulate. (1957.)

(5537.) Exceptions. In *Alzatea* and *Crypteronia* the flowers are apetalous; in the latter they are also monœcious, in *Actegeton* diœcious, and polygamous in *Maytenus.*

(5538.) *DULONGIDÆ.* Celastrineæ *illegitimæ.*

GEN. RULE. Ib. The sepals being valvate in æstivation. (1933.)

(5539.) *AQUIFOLIACEÆ, De Cand.* Rhamni (part of), *Juss.*

GEN. RULE. Catapetalous angiospermous dicotyledons, with definite perigynous stamens, alternate with the petals; the sepals imbricate, the carpels several, superior, and the seeds solitary, exarillate, and albuminous. (1921.)

(5540.) *AQUIFOLIDÆ.* Aquifoliaceæ, *De Cand.* Ilicineæ, *Brongniart.*

GEN. RULE. Ib. The corolla staminiferous and hypogynous, the ovary truncate, the fruit fleshy, and the seeds pendulous, sessile, and with a small chalaza; the leaves exstipulate. (1925.)

(5541.) *STACKHOUSIDÆ.* Stackhouseæ, *Brown.*

GEN. RULE. Ib. The calyx corolliferous and staminiferous; the styles lateral, ovarium lobed, fruit dry, and seeds erect; the leaves are furnished with stipules. (1924.)

QUERNEALES.

(5542.) *SYN.* Dicotyledones Imperfectæ *vel* Apetalæ, *Ray.* Dicotyledones Apetalæ *et* Diclines Irregulares (in part), *Juss.* Dicotyledones Incompletæ, *De Cand.* Exogenæ Apetalæ, or Monochlamydeæ, *et* Achlamydeæ, *De Cand.*, &c. Veg. Dicotyledonea Gymnoblasta Apetala, *Bartl.*

GEN. RULE. Apetalous *Rosares*, that is, a- or mono-chlamydeous angiospermous dicotyledons or exogenæ, the corolla being absent, or united with the calyx. (1508.)

(5543.) Exceptions. Petals are occasionally developed, as in some *Euphorbiaceæ*, and petaloid processes (barren filaments) occur in *Chailetiaceæ* and *Aquilariaceæ*.

Apetalous flowers are found also among the *Rosales;* and sometimes, though very seldom, among the *Syringales.* q. v.

EUPHORBINÆ.

(5544.) *SYN.* Tricoccæ (part of), *Lin.*, *Bartl.* Euphorbiæ, &c., *Juss.*

GEN. RULE. A- mono- or di-chlamydeous angiospermous exogenæ, with separated flowers; the perianth, when present, imbricate in æstivation; the germen superior, mostly 3-celled, and the seeds with fleshy albumen and straight axile embryo.

(5545.) *Obs.* The *Begoniaceæ* (if belonging to the section,) are abnormal, from having an inferior germen.

(5546.) *EMPETRACEÆ.* Eric. Aff, *Juss.* Empetreæ, *Nuttall, Don.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with imbricated scale-like sepals and definite alternate stamens; the germen superior, 3-6-9 celled, the ovules solitary and ascending, and the seeds with a fleshy watery albumen, and straight axile embryo. The juices watery, not lactescent.

(5547.) Rudimentary petals are said to be occasionally developed. (1893.)

(5548.) *EUPHORBIACEÆ, Brown.* Euphorbiæ, *Juss.* Tithymaloideæ, *Vent.*

GEN. RULE. A- or mono-, seldom di- chlamydeous angiospermous exogenæ, with separated flowers; a free germen, mostly 3-celled, definite pendulous seeds, with carunculate testæ and oily fleshy albumen. The sap is lactescent. (1847.)

(5549.) *Obs.* Sometimes the carpels are but 2, and occasionally there are more than 3. The sap is not always milky.

(5550.) *BUXIDÆ.*

GEN. RULE. Ib. The seeds being 2 in each cell, and the stamens definite. (1851.)

(5551.) *EUPHORBIDÆ.*

GEN. RULE. Ib. The seeds being solitary, and the stamens definite or indefinite. (1850.)

(5552.) *BEGONIACEÆ, Brown.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with a superior, irregular, petaloid calyx, imbricate in æstivation, indefinite stamens, an inferior 3-celled germen, and many-ovuled placentæ, the fruit capsular, crowned with the marcescent perianth, and winged. The seeds many and small, with striated naked testæ, and fleshy (not oily) albumen. The leaves have membranous stipules. (1844.)

RUMICINÆ.

(5553.) *SYN.* Holoraceæ (chief part), *Lin.* Fagopyrinæ and part of Caryophyllinæ, *Bart.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with the perianth often coloured and imbricate in æstivation, flowers mostly united, germen free, albumen mealy (seldom absent), and the embryo curved. Stems in general herbaceous and non-lactescent, and the leaves simple. (1771.)

(5554.) EXCEPTIONS. The flowers are sometimes diœcious, as in *Rumex Acetosa*, and *Acetosella*, and occasionally polygamous, as in *Atriplex*. In the *Petiveridæ* the seeds are without albumen.

(5555.) *POLYGONACEÆ.* POLYGONEÆ, *Juss.*, &c.

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with connate, often coloured imbricate sepals, definite perigynous stamens, superior germen, solitary erect seeds, inverted embryo, and mealy albumen. The leaves simple, alternate, and the stipules ocreate. (1820.)

(5556.) EXCEPTIONS. In *Eriogonum* the nodi are pubescent, and the ocreæ abortive.

(5557.) *NYCTAGINACEÆ.* NYCTAGINES, *Juss.* NYCTAGINEÆ, *Brown.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with a tubular calyx, the limb plaited in æstivation, definite hypogynous stamens, superior germen, fruit enclosed by the hardened persistent tube of the calyx, seeds solitary, erect, radicle inferior, and albumen mealy. Leaves mostly opposite, and without stipules. (1814.)

(5558.) EXCEPTIONS. The seeds are apparently without seed-coats, from the close adherence of the testa to the true pericarp, the hardened calyx simulating a pericarp.

(5559.) *SCLERANTHACEÆ.* ILLECEBREÆ (QUERIACEÆ et MINUARTIEÆ), *De Cand.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with definite perigynous stamens opposite the sepals, which are imbricate in æstivation, the germen superior and 1-celled; the seed solitary and pendulous, the albumen mealy, and the embryo curved. (1807.)

(5560.) *POLLICHIDÆ.* POLLICHIEÆ ILLECEBREÆ (part of), *De Cand.*

GEN. RULE. Ib. The leaves somewhat whorled, and the bracteæ and sepals becoming succulent, aud forming a fleshy fruit. (1812.)

(5561.) *ILLECEBRIDÆ.* ILLECEBREÆ VERÆ, *De Cand.*

GEN. RULE. Ib. The leaves having scarious stipulæ, and the flowers scarious bracteæ, the sepals often distinct, and the curved embryo lying on one side of the albumen. (1811.)

(5562.) *SCLERANTHIDÆ.* SCLERANTHEÆ, *Link.* QUERIACEÆ MINUARTIEÆ, *De Cand.*

GEN. RULE. Ib. The leaves exstipulate, calyx tubular, indurated, and investing the ovary; the embryo curved round the albumen. (1810.)

(5563.) *BETACEÆ.* AMARANTHI et ATRIPLICES, *Juss.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with definite stamens (5 or less) opposite the sepals, which are imbricate in æstivation. The germen superior, 1-celled, the seeds 1 or more, albumen mealy (seldom absent) and the embryo curved or spiral. The leaves are simple, alternate, and exstipulate. (1735.)

(5564.) EXCEPTION. Leaves sometimes, but rarely opposite.

(5565.) *AMARANTIDÆ.* AMARANTHI, *Juss.* AMARANTHACEÆ, *Brown.* AMARANTACEÆ, *Lind.*

GEN. RULE. Ib. The flowers shewy, the perianth being coloured and involucrate; the stamens hypogynous, and often connate; the seeds (one or more) with mealy albumen. (1789.)

(5566.) EXCEPTION. The stamens are sometimes perigynous, and occasionally a supernumerary whorl is developed, but these are mostly barren.

(5567.) *CHENOPODIDÆ.* ATRIPLICES, *Juss.* CHENOPODEÆ, *Vent. De Cand.*, &c.

GEN. RULE. Ib. The flowers inconspicuous, perianth herbaceous and

ebracteate, stamens free and perigynous, seed solitary, and the albumen sometimes absent. (1788.)

(5568.) EXCEPTIONS. Stamens occasionally hypogynous.

(5569.) *PETIVERIACEÆ, Link.* ATRIPLICES (part of), *Juss.* PETIVERIEÆ, *Agardh.*

GEN. RULE. Monochlamydeous, angiospermous dicotyledons, with perigynous stamens, definite or indefinite, (5 or more,) alternate with the sepals when few; and abinvolucrate flowers. The ovarium superior, 1 or more celled, the seeds solitary and erect, and the radicle inferior.

(5570.) *PHYTOLACCIDÆ.* PHYTOLACCEÆ, *Brown.*

GEN. RULE. Ib. The leaves exstipulate, ovary 1-10 celled, stigmata terminal, and embryo curved round mealy albumen. (1781.)

(5571.) *Obs.* The ovary is many-celled in all the genera save *Rivina*, in which it is formed of a single carpel. The carpels are also distinct in *Gisekia*, and nearly so in one species of *Phytolacca*.

(5572.) *PETEVERIDÆ.* PETEVERIEÆ, *Agardh.*

GEN. RULE. Ib. The leaves stipulate, the ovary 1-celled, the stigma lateral, the albumen evanescent or abortive, and the cotyledons spirally convolute. (1780.)

ASARINÆ.

(5573.) *SYN.* ASARINEÆ (part of, VEG. DICOTYLEDONEA CHLAMYDOBLASTA,) *Bartl.*

GEN. RULE. Monochlamydeous angiospermous exogenæ or dicotyledons, with definite stamens, variable in exsertion; a plurilocular ovary, numerous ovules, central or subcentral placentæ, many albuminous seeds, and an included embryo. (1755-6.)

(5574.) EXCEPTIONS. In *Nepenthes* the stem is scarcely exogenous, and in *Aristolochiaceæ* the embryo is undivided before germination.

(5575.) *NEPENTHACEÆ.* NEPENTHINÆ, *Link.* NEPENTHEÆ, *Lind.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with subdefinite, hypogynous, monadelphous stamens, an imbricate perianth, ovarium superior and 4-celled, ovules indefinite, seeds albuminous, and the embryo distinctly 2-lobed. The leaves are ascidiate.

(5576.) *ARISTOLOCHIACEÆ.* ARISTOLOCHIEÆ, *Juss.*, &c. PISTOLOCHINÆ et ASARINÆ, *Link.* ASARINEÆ, *Brown.*

GEN. RULE. Monochlamydeous angiospermous exogenæ, with definite epigynous stamens, a synsepalous calyx valvate in æstivation, the germen inferior, 3-6 celled, the seeds many and albuminous, and the embryo minute and undivided before germination. The leaves not ascidiate, but often stipulate. (1757.)

(5577.) *ASARIDÆ.* (1761.)

GEN. RULE. Ib. The stamens being free and simply epigynous.

(5578.) *ARISTOLOCHIDÆ.*

GEN. RULE. Ib. The flowers being gynandrous. (1760.)

PIPERINÆ.

(5579.) *SYN.* PIPERITÆ (part of), *Lin.* URTIC. AFF., *Juss.*

GEN. RULE. Achlamydeous angiospermous exogenæ, with a spadiciform inflorescence, definite or indefinite stamens, albuminous seeds and included embryo, the vitellus being in general persistent. (1739.)

(5580.) *CHLORANTHACEÆ.* CHLORANTHEÆ, *Brown.*

GEN. RULE. Achlamydeous angiospermous exogenæ, with definite lateral stamens and 1-celled anthers. The ovary 1-celled, the fruit drupaceous and dehiscent, the seed pendulous, and the embryo lying at the apex of fleshy albumen, the vitellus not being persistent. The leaves opposite, with sheathing petioles. (1751.)

(5581.) *PIPERACEÆ, Rich.*

GEN. RULE. Achlamydeous angiospermous exogenæ, with definite stamens and 1-2 celled anthers. The ovary 1-celled, the seed solitary, erect, and albuminous; and the embryo included within the persistent vitellus. The leaves opposite (or alternate by abortion) and exstipulate. (1743.)

(5582.) *Obs.* According to Richard and Blume, the embryo is monocotyledonous.

(5583.) *SAURURACEÆ.* SAURUREÆ, *Rich.*

GEN. RULE. Achlamydeous angiospermous dicotyledons, with definite stamens and 2-celled anthers, the germen formed of 4 carpels, seeds few, ascending and albuminous, and the embryo included within the vitellus. The leaves alternate and stipulate. (1740.)

HIPPURINÆ.

GEN. RULE. Apetalous angiospermous exogenæ, with definite stamens, the cotyledons being variable and abnormal in size or number. Herbaceous or suffruticose aquatics.

(5584.) EXCEPTION. Petals are developed in *Trapaceæ,* and sometimes in *Haloragidæ.*

(5585.) *CERATOPHYLLACEÆ.* CERATOPHYLLEÆ, *Gray, De Cand.*

GEN. RULE. Monochlamydeous angiospermous exogenæ, with monœcious flowers, a superior free ovarium, 1-celled and 1-seeded; the embryo exalbuminous, with 4 cotyledons and a compound plumule; submerged floating plants, with multifid leaves. (1733.)

(5586.) *TRAPACEÆ.* HYDROCARYES, *Link.* ONAGRARIEÆ (part of), *De Cand.*

GEN. RULE. Dichlamydeous angiospermous exogenæ, with definite (4) perigynous stamens, an inferior germen and definite pendulous ovules; the seed solitary and exalbuminous, and with 2 very unequal cotyledons. (1730.)

(5587.) *HIPPÚRIDACEÆ.* HALORAGEÆ, *Brown,* &c.

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with definite stamens, an inferior germen and albuminous seeds, with the 2 cotyledons very minute. (1722.)

(5588.) EXCEPTIONS. In the *Haloragidæ* petals are sometimes developed.

(5589.) *CALLITRICHIDÆ.* CALLITRICHINEÆ, *Link.*

GEN. RULE. Ib. Flowers mostly separate, stamens 1-2, and the anther 1-celled. Bracteæ 2, and petaloid; limb of calyx obsolete; fruit 4-celled, seeds solitary and peltate. (1727.)

(5590.) *HIPPURIDÆ.* HALORAGEÆ (part of), *Brown.* HIPPURIDEÆ, *Link* and *Bartl.*

GEN. RULE. Ib. Flowers monandrous, limb of calyx entire and very small; anthers 2-celled, fruit 1-celled and 1-seeded. (1726.)

(5591.) *HALORAGIDÆ.* HALORAGEÆ (part of), *Brown,* &c. CERCODIANÆ, *Juss.* HYGROBIEÆ, *Rich.*

GEN. RULE. Ib. The limb of the calyx evidently lobed, petals often present, stamens more than 2 (3-8), seeds solitary and pendulous. (1725.)

LAURINÆ.

(5592.) *SYN.* HOLORACEÆ et VEPRECULÆ (part of), *Lin.* CLASS VI., PERISTAMINÆ, *Juss., Rich.* PROTEINÆ, *Bartl.*

GEN. RULE. Monochlamydeous angiospermous exogenæ, with the flowers in general united, and the perianth mostly coloured. The fruit 1 or many seeded, albumen none, or if present not mealy, but either fleshy or ruminated. The stems arborescent or shrubby, seldom herbaceous, and the leaves exstipulate. (1662.)

(5593.) EXCEPTIONS. Vide *Penæaceæ,* in which the seeds are homogenous, the embryo and cotyledons not being distinguishable; *Myristicaceæ,* in which the seeds have ruminated albumen; and *Santalaceæ,* in which it is fleshy. See also *Thymelæaceæ* and *Cassythidæ.*

(5594.) *TERMINALIACEÆ.* Terminalieæ (part of Combretaceæ), *De Cand.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with a superior calyx, the limb valvate and deciduous. Stamens definite and perigynous, ovarium 1-celled, without any central column; seeds definite, pendulous, and exalbuminous, and the cotyledons spiral. (1715.)

(5595.) *SANTALACEÆ, Brown.* Onagrariæ et Elæagni (part of), *Juss.* Osyrinæ, *Link.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with the calyx mostly superior, and valvate in æstivation; the ovarium 1-celled, and the seeds solitary and exarillate, with fleshy albumen. (1706.)

(5596.) Exception. See *Osyridæ.*

(5597.) *SANTALIDÆ.* Santalaceæ Legitimæ.

GEN. RULE. Ib. The ovarium inferior, 3-ovuled fruit, 1-seeded by abortion, and the embryo round. (1711.)

(5598.) *NYSSIDÆ.*

GEN. RULE. Ib. The ovarium inferior, 1-ovuled and 1-seeded; embryo not cylindrical, cotyledons foliaceous. (1710.)

(5599.) *OSYRIDÆ.* Calyciflora (part of), *Lin.* Osyrideæ, *Juss.* Anthoboleæ, *Brown.*

GEN. RULE. Ib. Ovarium free and superior, with a ternary disposition in the flowers. (1709.)

(5600.) *Obs.* Exocarpus is remarkable for bearing its flowers on the edges of dilated foliaceous processes, indistinguishable from leaves.

(5601.) *PENÆACEÆ, Brown.*

GEN. RULE. Monochlamydeous angiospermous exogenæ, with an inferior bracteate hypocrateriform calyx, the limb either valvate or imbricate in æstivation. The flowers united, with a quaternary disposition; the seeds definite and exalbuminous, and the embryo solid and homogeneous, without the regular distinction of parts. (1700.)

(5602.) *Obs.* The bracteæ have sometimes been mistaken for sepals, and *Penæa* thus considered dichlamydeous and monopetalous. Vide (1703.)

(5603.) *PROTEACEÆ, Brown.* Proteæ, *Juss.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with definite perigynous stamens opposite the sepals, which are valvate in æstivation. The calyx tubular and free, the germen superior, and the seeds definite, erect, and exalbuminous. The leaves are exstipulate, and peculiarly harsh and dry. (1697.)

(5604.) Exception. In *Franklandia* the æstivation is said, by Brown, to be induplicate.

(5605.) *THYMELÆACEÆ.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with definite perigynous stamens, calyx tubular, and the lobes imbricate in æstivation. The germen superior, 1-celled and 1-seeded. The seeds solitary, and the albumen none, or very spare. (1688.)

(5606.) *ELÆAGNIDÆ.* Calycifloræ (part of), *Lin.* Elæagni, *Juss.* Elæagneæ, *Rich.*

GEN. RULE. Ib. The perianth scabrous and persistent, covering the fruit when ripe; the stamens alternate with its lobes, the ovule and the embryo both erect. The leaves rough and scaly. (1692.)

(5607.) *Obs.* The flowers are in general diœcious.

(5608.) *THYMÆLIDÆ.* Veprecula (part of), *Lin.* Thymelæ, *Juss.*, &c.

GEN. RULE. Ib. The calyx being coloured, often bearing within it petaloid scales, and not investing the fruit. The stamens opposite the sepals, when equal

to them in number. The ovule pendulous, and the embryo inverted. The leaves smooth. (1691.)

(5609.) *HERNANDIACEÆ.* Laur. Aff. *Juss.* Hernandieæ, *Blume.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with involucellate (often separate) flowers; an inferior, tubular, deciduous calyx; definite perigynous stamens, superior 1-celled germen, with solitary, pendulous, exalbuminous seeds, and the embryo with lobed cotyledons. (1683.)

(5610.) *MYRISTICACEÆ.* Laur. Aff. *Juss.* Myristiceæ, *Brown.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with diœcious flowers; a trifid valvate calyx, definite monadelphous stamens, a superior 1-celled ovary, with a solitary erect seed, furnished with an arillus and ruminated albumen. (1676.)

(5611.) *LAURACEÆ.* Holoraceæ, η *Lin.* Lauri, *Juss.* Laurineæ, *Vent.*, &c.

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with united flowers, an inferior calyx, imbricate in æstivation, definite, perigynous, discrete stamens, the anthers dehiscent by recurved valves, the ovary superior, ovules solitary and pendulous, and the seeds exalbuminous and exarillate. (1663.)

(5612.) *CASSYTHIDÆ.*

GEN. RULE. Ib. Stems leafless and herbaceous, and secretions insipid. (1667.)

(5613.) *LAURIDÆ.*

GEN. RULE. Ib. Stems leafy and arborescent, and the secretions aromatic. (1666.)

URTICINÆ.

(5614.) *SYN.* Scabridæ, *Lin.* Urticæ, *Juss.*

GEN. RULE. Apetalous angiospermous dicotyledons, with usually separated flowers, amentaceous or subamentiform inflorescence, superior germen, and solitary albuminous seeds. (1585.)

(5615.) Exception. Flowers sometimes united.

(5616.) *MONIMIACEÆ.* Monimieæ, *Juss.* Atherospermeæ, *Brown.*

GEN. RULE. Apetalous angiospermous dicotyledons, with sessile involucrate flowers, indefinite perigynous stamens, anthers dehiscent lengthwise, carpels several and superior, seeds solitary, and with abundant albumen. (1655.)

(5617.) *ATHEROSPERMIDÆ.* Atherospermeæ, *Brown.*

GEN. RULE. Ib. The anthers dehiscent by recurved valves, and the ovule erect, and the radicle inferior. (1659.)

(5618.) *AMBORIDÆ.* Monimieæ (part of), *Juss.*

GEN. RULE. Ib. The anthers dehiscing by a simple chink, the seeds pendulous, and the radicle superior. (1658.)

(5619.) *DATISCACEÆ.* Miscellaneæ, *a Lin.* Datisceæ, *Brown.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with regular flowers; the germen inferior, 1-celled, with parietal placentæ and indefinite ovules. The fruit capsular and hiant at the apex, the seeds many, with a finely reticulated testa, fleshy albumen, and straight embryo. (1652.)

(5620.) *URTICACEÆ.* Scabridæ (part), *Lin.* Urticeæ (part), *Juss.* Urticeæ, *De Cand.* Do. including Cænosantheæ et Cannabinæ, *Blume*, with Lacistemeæ, *Mart.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with an amentaceous inflorescence, definite stamens, germen superior, 1-celled, and mostly

1-seeded, albumen in general present, and the radicle superior. Leaves alternate and stipulate; not lactescent. (1631.)

(5621.) EXCEPTIONS. Albumen sometimes wanting in the *Urticidæ* and *Cannabidæ*.

(5622.) *LACISTEMIDÆ*. URTICEÆ (part of), *Auct.* LACISTEMEÆ, *Martius.*

GEN. RULE. Ib. The stamens hypogynous and unilateral, with a thick 2-lobed connectivum, and anthers dehiscing transversely, ovules many, fruit capsular and dehiscent, seed in general solitary by abortion, pendulous, arillate, and albuminous. (1636.)

(5623.) *CANNABIDÆ*. CANNABINÆ, *Blume, Bartl.*, &c.

GEN. RULE. Ib. The stamens perigynous, opposite the sepals, straight in æstivation, and not irritable; the embryo curved or spiral; fruit indehiscent. (1635.)

(5624.) *URTICIDÆ*. URTICEÆ VERÆ, *Bartl.*, &c.

GEN. RULE. Ib. The stamens perigynous, opposite the sepals, induplicate in æstivation, and irritable; fruit indehiscent, and the embryo straight. (1634.)

(5625.) *PLATANACEÆ*. SCABRIDÆ (part of), *Juss.* ARTOCARPEÆ, *De Cand.*

GEN. RULE. Apetalous angiospermous dicotyledons, with congested subamentaceous (seldom solitary) flowers; definite stamens, germen free or but slightly adherent, imbedded in a fleshy receptacle or invested by the persistent calyx, the seed solitary, pendulous and albuminous, and the embryo mostly curved. The leaves are alternate and stipulate. (1590.)

(5626.) EXCEPTION. In the *Antiaridæ* the flowers are solitary. The albumen is sometimes absent.

(5627.) *ANTIARIDÆ*. ARTOCARPEÆ SPURIÆ.

GEN. RULE. Ib. The flowers solitary and monochlamydeous, the nuts invested by the persistent bracteæ, sap milky. (1596.)

(5628.) *ARTOCARPIDÆ*. ARTOCARPEÆ, *Brown.* ARTOCARPEÆ et PHOLEOSANTHEÆ, *Blume.* SYCOIDEÆ, *Link.*

GEN. RULE. Flowers congested and monochlamydeous, lactescent. (1595.)

(5629.) *PLATANIDÆ*. URTICÆ (part of), *Juss.* ARTOCARPEÆ (part of), *De Cand.*

GEN. RULE. Flowers monandrous, separate, achlamydeous and congested, non-lactescent. (1594.)

(5630.) *STILAGINACEÆ*. STILAGINEÆ, *Agardh.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with a spicate inflorescence, separated flowers, definite stamens, the anthers dehiscing transversely, ovarium superior, with definite collateral pendulous ovules, fruit drupaceous, with a solitary suspended seed, and a green foliaceous embryo placed in the midst of fleshy albumen. (1586.)

ULMINÆ.

(5631.) *SYN.* SCABRIDÆ (part of), *Lin.* AMENTACEÆ (part), *Juss., Bartl.*, &c.

GEN. RULE. Mono- or sub-dichlamydeous angiospermous dicotyledons, the inflorescence subamentiform, the flowers united, the stamens definite, the germen free, and the seeds solitary and exalbuminous. Leaves simple and alternate. (1570.)

(5632.) EXCEPTIONS. Petaloid or scale-like processes (? barren filaments) are developed in the *Chailletiaceæ* and *Aquilariaceæ*, and in the *Ulmaceæ* the flowers are sometimes polygamous.

(5633.) *AQUILARIACEÆ*. AQUILARINEÆ, *Brown.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with definite monadelphous stamens, 10 fertile and 10 barren or scale-like, the ovarium supe-

rior, 1-2-celled, with 2 suspended ovules; the seed solitary, erect(?) appendiculate and exalbuminous; leaves simple and exstipulate. (1581.)

(5634.) *CHAILLETIACEÆ, De Cand.* CHAILLETIEÆ, *Brown.*

GEN. RULE. Sub-dichlamydeous angiospermous dicotyledons, with definite perigynous stamens, 5 fertile and 5 barren and petaloid; the ovarium superior, 2-3-celled, ovules twin and pendulous, seeds solitary, pendulous and exalbuminous, cotyledons thick; leaves simple, alternate and stipulate. (1578.)

(5635.) *ULMACEÆ, Mirb.* CELTIDEÆ, *Rich.*, &c.

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with definite perigynous stamens, all fertile, superior 2-celled germen, and solitary pendulous exalbuminous seeds; the cotyledons foliaceous, and the leaves simple, alternate, serrate and stipulate. (1573.)

QUERCINÆ.

(5636.) *SYN.* NUCIFERÆ, LANIGERÆ et JULIFERÆ, *Ray.* AMENTACEÆ, *Lin.*, *Juss.*, &c.

GEN. RULE. Apetalous angiospermous dicotyledons, with amentaceous separated flowers and exalbuminous seeds. (1510.)

CORYLIANÆ.

(5637.) GEN. RULE. Ib. The germen being inferior.

(5638.) *JUGLANDACEÆ.* NUCIFERÆ (part of), *Ray.* JUGLANDEÆ, *De Cand.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with separated flowers, the stamineous ones in aments, stamens hypogynous, definite or indefinite, germen inferior 1-celled, the ovule solitary and erect, the seed exalbuminous with wrinkled cotyledons. Leaves alternate, pinnate, impunctate and exstipulate. (1563-4.)

(5639.) EXCEPTIONS. Petals sometimes developed in the pistilline flowers.

(5640.) *CORYLACEÆ, Mirb.* NUCIFERÆ (part of), *Ray.* CUPULIFERÆ, *Rich.* QUERCINEÆ, *Juss.*

GEN. RULE. Monochlamydeous angiospermous dicotyledons, with separated flowers, the stamineous ones in aments, the pistilline in cupules; the ovarium inferior 1-celled, seeds definite, pendulous and exalbuminous, with smooth cotyledons. Leaves alternate and stipulate, with costomarginal ribs.

BETULIANÆ.

(5641.) GEN. RULE. Ib. (5636.) The germen being free.

(5642.) *BETULACEÆ, Bartl.* CONIFERÆ NON RESINIFERÆ, *Ray.* AMENTACEÆ (part of), *Lin.* and *Juss.* BETULINEÆ, *Rich.*

GEN. RULE. Apetalous angiospermous dicotyledons, with monœcious strobiliform flowers, a free 2-celled germen, with definite pendulous ovules, the fruit 1-celled, and the seeds pendulous and exalbuminous, with downless solitary testæ. Leaves simple and alternate, with costomarginal ribs and deciduous stipules. (1534.)

(5643.) *Obs.* The flowers are usually achlamydeous, but in the stamineous ones a calyx is sometimes developed.

(5644.) *SALICACEÆ.* LANIGERÆ, *Ray.* AMENTACEÆ (part of), *Lin.* and *Juss.* SALICINEÆ, *Rich.*

GEN. RULE. Achlamydeous angiospermous dicotyledons, with monœcious or diœcious flowers and amentiform inflorescence, a superior 1-2-celled germen, with multiovulate parietal placentæ. The seeds many, exalbuminous and comose; the leaves simple and alternate, with deliquescent costules and persistent or deciduous stipules. (1522.)

(5645.) *MYRICACEÆ.* CONIFERÆ (part of), *Ray.* AMENTACEÆ (part), *Lin.*, *Juss.*, &c.

GEN. RULE. Achlamydeous angiospermous dicotyledons, with separate flowers, amentaceous or strobiliform inflorescence, free 1-celled ovarium, with solitary erect exalbuminous seeds. The branches exarticulate, and the leaves simple and alternate. (1517.)

(5646.) *CASUARINACEÆ.* AMENTACEIS AFF., *Juss.*, CASUARINEÆ, *Mirb.*

GEN. RULE. Achlamydeous angiospermous dicotyledons, with separate flowers, strobiliform inflorescence, superior 1-celled ovarium and solitary erect exalbuminous seeds. The branches articulate, vaginate and leafless. (1511.)

(5647.) *Obs.* It is questionable whether the 4-valved envelope in the *Casuarinæ* should be considered an involucrum or a calyx. Between the pericarp and the testa Brown has noticed a stratum of spiral *vessels.*

PINEALES.

(5648.) *SYN.* CONIFERÆ, *Ray*, *Lin.*, *Juss.*, &c.

GEN. RULE. Gymnospermous exogenæ with branched stems, simple leaves, linear costules, non-gyrate vernation, and resinous juices. (1400.)

(5649.) *TAXINÆ.* TAXACEÆ. BACCIFERÆ (part), *Ray.* CONIFERÆ (part), *Juss.*, *De Cand.*, &c.

GEN. RULE. Ib. The pistilline flowers being distinct, and the fruit a taxule, *i. e.* the solitary seed invested by a succulent scale. (1405.)

(5650.) *CUPRESSINÆ.* THUJACEÆ. BACCIFERÆ (part), *Ray.* CONIFERÆ (part), *Lin.*, *Juss.*, &c.

GEN. RULE. Ib. The pistilline flowers being congested and erect, and the fruit a galbule. (1404.)

(5651.) *ABIETINÆ.* PINACEÆ.

GEN. RULE. Ib. The pistilline flowers being congested and reversed, and the fruit a strobile or true scaly cone. (1403.)

ZAMIALES.

(5652.) *CYCADINÆ.* CYCADACEÆ. CYCADEÆ, *Rich.* FILICIBUS AFF., *Lin.* FILICES, *Juss.*

GEN. RULE. Gymnospermous exogenæ, with simple stems, rarely developing more than a single bud; divided leaves, gyrate vernation, and mucilaginous secretions, (1393, &c.)

MUSALES.

GEN. RULE. Flowering endogenæ or monocotyledons, with a corollaceous perianth and inferior germen. (1206.)

(5653.) EXCEPTIONS. In the *Tillandsidæ* of the *Bromeliaceæ* the germen is superior.

HYDROCHARINÆ.

(5654.) *SYN.* PALMÆ, *β. Lin.* HYDROCHARIDES, *Juss.* HYDROCHARIDEÆ, *Brown.*

GEN. RULE. Aquatic monocotyledons, with a tripetaloid perianth, indefinite or definite free stamens, an inferior ovarium, exalbuminous seeds, and the embryo straight, with an inferior radicle. (1297-9.)

(5655.) *VALLISNERIACEÆ, Link.*

GEN. RULE. Ib. The flowers being diœcious, the stamineous ones with a synpetalous corolla, and the pistilline ones with the petals distinct. Fruit capsular, and 1-celled, with many-seeded parietal placentæ. (1303-6.)

(5656.) *HYDROCHARACEÆ.*

GEN. RULE. Ib. Petals discrete, fruit a coriaceous capsule (not baccate), and the leaves with parallel and transverse veins. (1302.)

(5657.) *STRATIOTACEÆ.* STRATIOTEÆ, *Link.*

GEN. RULE. Ib. Flowers apopetalous and spathaceous, calyx tubular, fruit a berry. Leaves with parallel veins, and sheathing at the base. (1301.)

ORCHIDINÆ.

(5658.) BULBOSIS AFF., *Ray.* ORCHIDEÆ, *Lin.* ORCHIDES, *Juss.*

GEN. RULE. Labiate petaloid monocotyledons, with an inferior twisted germen, gynandrous stamens and albuminous seeds. (1273.)

(5659.) *ORCHIDACEÆ.* ORCHIDEÆ VERÆ, *Auct.*

GEN. RULE. Ib. The stamen single and median, the germen 1-celled, with 3 parietal placentæ. (1281.)

(5660.) *Obs.* The leaves are sometimes articulated with the stem.

(5661.) *CYPRIPEDIACEÆ.*

GEN. RULE. Ib. The stamens 2 and lateral, the germen 1-celled, with 3 parietal placentæ. (1282.)

(5662.) *APOSTASIACEÆ.*

GEN. RULE. The stamens 2 or 3, the anthers discrete, and the germen 3-celled. (1383.)

(5663.) *SCITAMINÆ.*

GEN. RULE. Flowering endogenæ or monocotyledons, with an inferior germen, tri- or hexa-petaloid perianths, central placentæ, albuminous seeds, and penninerved leaves. (1254.)

(5664.) *MARANTACEÆ.* MARANTEÆ or CANNÆ, *Brown.* CANNACEÆ, *Agardh.* CANNÆ (part of), *Juss.* SCITAMINEÆ (part of), *Lin.*

GEN. RULE. Tripetaloid endogenæ, with an inferior germen, monandrous flowers, the single fertile stamen lateral, and the anther 1-celled; the leaves penninerved. (1270.)

(5665.) *Obs.* The ovary is in general 3-celled and several-seeded, but in *Thalia* it is 1-celled and 1-seeded.

(5666.) *ZINGIBERACEÆ, Rich.* CANNÆ (part of), *Juss.* AMOMEÆ, *Rich.* DRYMYRRHIZEÆ, *Vent.* SCITAMINEÆ (part of), *Lin.* SCITAMINEÆ, *Brown.* ALPINIACEÆ, *Link.*

GEN. RULE. Tripetaloid endogenæ, with an inferior germen, monandrous flowers, the single fertile stamen being median, and the anthers 2-celled; the leaves penninerved. (1264.)

(5667.) *Obs.* In *Globba* the ovarium is 1-celled, with 3 parietal placentæ; in *Hellenia abnormis* the ovary is 1-celled and 1-seeded.

(5668.) *MUSACEÆ, De Cand., Agardh.,* &c. SCITAMINEÆ (part of), *Lin.* MUSEÆ, *Juss.*

GEN. RULE. Hexapetaloid endogenæ, with an inferior ovarium, pent- or hex-androus flowers; the leaves penninerved. (1263.)

(5669.) *Obs.* The plane of the leaf is sometimes abortive in *Strelitzia*; and in *Heliconia* the ovules are solitary.

NARCISSINÆ.

(5670.) GEN. RULE. Flowering endogenæ or monocotyledons, with an inferior germen, tri- or hexa-petaloid perianths, central placentæ and albuminous seeds; the leaves are nervo-striated. (1219.)

(5671.) EXCEPTIONS. The ovarium is superior in the *Tillandsidæ*, and in *Wachendorfia* of the *Hæmodoridæ.*

(5672.) *IRIDACEÆ.* ENSATÆ, *Lin.* IRIDES, *Juss.* IRIDEÆ, *Gawler, Brown,* &c.

GEN. RULE. Hexapetaloid endogenæ, with triandrous flowers and extrorse

anthers, stamens opposite the sepals, an inferior 3-celled ovary, with albuminous seeds, and nervo-striated equitant leaves. (1245.)

(5673.) EXCEPTION. In crocus the leaves are scarcely, or not all, equitant.

(5674.) *FERRARIDÆ.*
GEN. RULE. Ib. The stamens being united or monadelphous. (1252.)

(5675.) *CROCIDÆ.*
GEN. RULE. Ib. The stamens being discrete. (1250.)

(5676.) *BURMANNIACEÆ.* NARCISSI (part), *Lin.* BROMELIACEÆ, *Juss.* AMARYLLIDEÆ (part), *Rich.*, &c.
GEN. RULE. Hexapetaloid (rarely tripetaloid) endogenæ, with an inferior ovarium, the perianth tubular, winged or hairy, stamens often 3, sometimes 6, and placed opposite the internal pieces of the perianth; the leaves are nervo-striated. (1240.)

(5677.) *BURMANNIDÆ.* BURMANNIEÆ, *Sprengel.* BURMANNIACEÆ, *Bartl.*
GEN. RULE. Hexapetaloid monocotyledons, with triandrous flowers, the anthers dehiscent transversely, the ovary inferior and winged, the seeds minute, indefinite and albuminous; the leaves nervo-striated, narrow, and acute, and often congested towards the root; the cauline ones smaller and semi-amplexicaul. (1244.)

(5678.) *HÆMODORIDÆ.* HÆMODORACEÆ, *Brown.*
GEN. RULE. Tri- or hexa-petaloid endogenæ, with an inferior ovarium, and albuminous seeds; stamens 3-6 or more, with introrse anthers, the perianth tubular, woolly, and the æstivation rarely equitant; the leaves mostly equitant. (1243.)

(5679.) EXCEPTIONS. Leaves not always equitant. The pieces of the perianth are equitant in *Vellozia;* and in *Wachendorfia* the germen is superior.

(5680.) *AMARYLLACEÆ* or *NARCISSACEÆ.* SPATHACEÆ ET CORONARIÆ (in part,) *Lin.* NARCISSI, *Juss.* AMARYLLIDEÆ, *Brown.* NARCISSEÆ, *Agardh.*
GEN. RULE. Hexandrous hexapetaloid endogenæ, with an inferior ovarium and albuminous seeds, the sepals equitant, and the leaves nervo-striated and loriform or ensiform. (1232.)

(5681.) EXCEPTIONS. In *Gethyllis* the stamens are numerous.

(5682.) *AMARYLLIDÆ.* AMARYLLIDEÆ, *Brown.*
GEN. RULE. Ib. The seeds having a soft, membranous or spongy testa; the leaves loriform. (1238.)

(5683.) *HYPOXIDÆ.* HYPOXIDEÆ, *Brown.*
GEN. RULE. Ib. The seeds having a hard black testa and beak-like hilum; the leaves rigid and plaited. (1237.)

(5684.) *BROMELIACEÆ, Lind.* CORONARIÆ (part), *Lin.* BROMELIÆ, *Juss.*
GEN. RULE. Tripetaloid endogenæ, with hexandrous flowers, the germen inferior or superior, 3-celled, seeds numerous and albuminous: and rigid channelled prickly leaves, often scabrous. (1222.)

(5685.) *BROMELIDÆ.*
GEN. RULE. Ib. The germen being inferior. (1227.)

(5686.) *TILLANDSIDÆ.*
GEN. RULE. Ib. The germen being superior.

TACCINÆ.

(5687.) GEN. RULE. Flowering endogenæ or monocotyledons, with an inferior ovary, hexapetaloid perianth, albuminous seeds, and petiolate leaves, often with reticulate venation and grumous roots. (1208.)

(5688.) *DIOSCORACEÆ.* DIOSCOREÆ, *Brown.*
GEN. RULE. Diœcious endogenæ, with an inferior ovarium and albuminous seeds, and the perianth subpetaloid; the stems twining, leaves petiolate, with a subreticulate venation. (1214.)

(5689.) *TACCACEÆ.* TACCEÆ, *Prest.* AROIDEÆ (part of), *Auct.*
GEN. RULE. Hexapetaloid endogenæ, with united flowers, an inferior germen, parietal placentæ, and albuminous seeds, with striated testæ; the leaves are radical, and either simple or compound. (1208.)

(5690.) **LILIALES.**
GEN. RULE. Flowering endogenæ, with a petaloid perianth, superior germen, and marginal ovules.

(5691.) *LILIACINÆ.*
GEN. RULE. Ib. The perianth hexapetaloid, and the seeds albuminous. (1166.)

(5692.) EXCEPTIONS. In *Campynema* of the *Colchicaceæ* the ovary is inferior.

(5693.) *SMILACEÆ, Brown.* SARMENTACEÆ (part), *Lin.* ASPARAGI (part), *Juss.* ASPARAGINEÆ, *Achil., Rich.* ASPARAGEÆ, *De Cand.* and *Duby.* TRILLIACEÆ, *De Cand.*
GEN. RULE. Hexapetaloid endogenæ, with a superior germen, flowers united or separate, perianth subcorollaceous, anthers introrse, fruit fleshy, and seeds albuminous, with a membranous spermoderm. (1203.)

Obs. The flowers have usually a ternary disposition; but in Paris the arrangement is quaternary; the leaves are sometimes reticulated.

(5694.) *SMILACIDÆ.* SMILACINÆ, *Link.* ASPARAGEÆ, *Bartl.*
GEN. RULE. Ib. The styles being connate. (1205.)

(5695.) *PARISIDÆ.* PARIDEÆ, *Link.* and *Bartl.*
GEN. RULE. Ib. The styles being distinct. (1204.)

(5696.) *COLCHICACEÆ, De Cand.* BULBOSÆ (part), *Ray.* SPATHACEÆ et CORONARIÆ (part), *Lin.* JUNCI (part), *Juss.* MELANTHIA, *Batsch.* MELANTHACEÆ, *Brown.* VERATREÆ, *Salisb.* MERENDERÆ, *Mirb.*
GEN. RULE. Specious hexapetaloid endogenæ, with hexandrous flowers, the anthers extrorse, the germen inferior, the styles distinct, and the carpels usually separable, the fruit capsular, and the seeds albuminous, with membranous testæ; the leaves with a simple linear costation, and sheathing at the base. (1200.)

(5697.) EXCEPTIONS. Anthers not always extrorse; germen inferior in *Campynema.*

(5698.) *LILIACEÆ, De Cand.* BULBOSÆ (part), *Ray.* CORONARIÆ (part), *Lin.* LILIA, *Juss.* TULIPACEÆ, *De Cand.* HEMEROCALLIDEÆ (part), *Brown.*
GEN. RULE. Specious hexapetaloid hexandrous endogenæ, with introrse anthers, superior germen, connate styles, 3-celled capsular fruit, with many albuminous seeds, having soft or spongy testæ. (1196.)

(5699.) *ASPHODELACEÆ.* BULBOSÆ (part), *Ray.* CORONARIÆ (part), *Lin.* ASPHODELI et ASPARAGI (part), *Juss.* ASPHODELEÆ, *Brown.* LILIACEÆ (part), *Link.*
GEN. RULE. Hexapetaloid hexandrous endogenæ, with introrse anthers, superior germen, connate styles, and albuminous seeds, with a dark brittle crustaceous spermoderm. (1169, 1176.)

(5700.) *Obs.* The fruit is usually capsular, and the carpels connate; but it is sometimes succulent, and occasionally, as in *Tricoryne*, the carpels are discrete. See also *Gillesidæ.*

(5701.) *ASPHODELIDÆ.* ASPHODELEÆ, *Lind.*
GEN. RULE. Ib. The perianth regular and well developed, and the podosperm not covered by a crustaceous tegument. (1178.)

(5702.) *GILLESIDÆ.* GILLESIEÆ, *Lind.*
GEN. RULE. The perianth depauperated and often irregular, the flowers invested by petaloid bracteæ, and the podosperm with a crustaceous tegument. (1179.)

(5703.) *PONTEDERIACEÆ, Ach. Rich.* PONTEDEREÆ, *Kunth.*
GEN. RULE. Hexapetaloid endogenæ, with a superior germen, the perianth irregular, circinnate in æstivation, and involute after flowering. The stamens

3-6, unequal, the fruit capsular, and the seeds indefinite and albuminous. (1174, 1168.)

(5704.) EXCEPTION. The germen is sometimes half inferior.

(5705.) *ALISMINÆ.*
GEN. RULE. Flowering endogenæ or monocotyledons, with a petaloid perianth, superior germen, exalbuminous seeds, and an uncleft embryo. (1157.)

(5706.) *BUTOMACEÆ.* TRIPETALOIDEÆ (part), *Lin.* JUNCI (part), *Juss.* ALISMACEÆ (part), *De Cand.* and *Duby.* BUTOMEÆ, *Rich.*
GEN. RULE. Tri- or sub-hexapetaloid monocotyledons, with a superior germen, branched parietal placentæ, and exalbuminous seeds. (1162.)

(5707.) *Obs. Limnocharis* is lactescent.

(5708.) *ALISMACEÆ, Brown.* TRIPETALOIDEÆ (part), *Lin.* JUNCI (part), *Juss.* ALISMACEÆ (part), *De Cand.* and *Duby.* ALISMOIDEÆ, *De Cand.*
GEN. RULE. Tripetaloid endogenæ or monocotyledons, with a superior germen formed of numerous distinct carpella, the placentæ simple, and the seeds without albumen. (1158.)

(5709.) *EPHEMERINÆ.*
GEN. RULE. Flowering endogenæ or monocotyledons, with tripetaloid perianths, superior germen, and albuminous seeds. (1148.)

(5710.) *EPHEMERACEÆ.* ENSATÆ (part), *Lin.* JUNCI (part), *Juss.* EPHEMEREÆ (part), *Batsch.* COMMELINEÆ, *Brown.*
GEN. RULE. Tripetaloid endogenæ, with a superior 2-3-celled capsular fruit, central placentæ, albuminous seeds, and trochlear embryo remote from the hilum; the leaves usually loriform and sheathing at the base. (1154.)

(5711.) *XYRIDACEÆ.* ENSATÆ (part), *Lin.* JUNCI (part), *Juss.* RESTIACEÆ (part), *Brown.* XYRIDEÆ, *Kunth.*
GEN. RULE. Tripetaloid endogenæ, with a superior 1-celled capsular fruit, parietal placentæ, and many albuminous seeds; the embryo ab-hilose. (1152.)

(5712.) *APHYLLANTHACEÆ.* TRIPETALOIDEÆ (part), *Lin.* JUNCI (part), *Juss.* APHYLLANTHEÆ, *Bartl.*
GEN. RULE. Tri- or sub-hexa-petaloid endogenæ, with a superior capsular fruit, central placentæ, and albuminous seeds; the embryo hilose and included. (1150.)

JUNCALES.

GEN. RULE. Flowering endogenæ or monocotyledons, with a superior germen, and the perianth glumaceous or absent.

(5713.) *JUNCINÆ.*
GEN. RULE. Glumaceous endogenæ, with a hexaphyllous perianth, superior germen, central placentæ, albuminous seeds and small embryo.

(5714.) *JUNCAÇEÆ.* TRIPETALOIDÆ (part), *Lin.* JUNCI (part), *Juss.* JUNCEÆ, *De Cand.*
GEN. RULE. Herbaceous endogenæ, with a six-pieced glumaceous perianth, superior germen, capsular fruit with central placentæ, seeds with soft testæ, and a small hilose embryo included within the albumen. (1139.)

(5715.) *RESTIACEÆ, Brown.* JUNCI (part), *Juss.*
GEN. RULE. Herbaceous or suffruticose endogenæ, with a six-pieced glumaceous perianth, a superior ovarium, with central placentæ, albuminous seeds, and the lenticular embryo excluded and remote from the hilum. (1137.)

(5716.) *Obs.* The fruit is usually dry and capsular, but it is succulent in *Willdenowia.*

(5717.) *NAYADINÆ.*
GEN. RULE. Achlamydeous or glumaceous monocotyledons, with a superior germen and exalbuminous seeds. (1128.)

(5718.) *Obs.* It is doubtful whether the *Podostemaceæ* are mono- or di-cotyledons.

(5719.) *JUNCAGINACEÆ.* GRAMINIFOLIÆ NON CULMIFERÆ, *Ray.* TRIPETALOIDEÆ (part), *Lin.* JUNCI (part), *Juss.* JUNCAGINEÆ, *Rich.*
GEN. RULE. Glumaceous or achlamydeous endogenæ, with hexandrous united flowers, a superior germen, dry fruit, erect exalbuminous seeds, and a lateral cleft in the embryo. (1130.)

(5720.) *Obs.* The perianth is much depauperated, and in *Lilæa* absent.

(5721.) *PODOSTEMACEÆ.* PODOSTEMEÆ, *Rich.*, &c.
GEN. RULE. Herbaceous aquatic monocotyledons, with united achlamydeous flowers, superior 2-celled capsule, seeds many and exalbuminous. (1131.)

(5722.) *Obs.* A question has been raised as to whether these plants are mono- or di- cotyledons. They doubtless show affinities to both series, as well as to the acotyledons. Martius refers them to their present station, in which he is supported by Kunth, Richard, &c.

(5723.) *NAYADACEÆ.* INUNDATÆ, *Lin.* NAIADES, *Juss.* FLUVIALES, *Vent.* POTAMOPHILÆ, *Rich.* POTAMEÆ, *Juss.* NAIADEÆ, *Agardh, Rich,* &c. HYDROGETONES, *Link.*
GEN. RULE. A- or monochlamydeous aquatic monocotyledons, with united or separated flowers, superior ovarium, fruit 1-celled, seed solitary, pendulous, and exalbuminous, with a lateral cleft for the exit of the plumule; leaves very cellular, with intrafoliaceous sheaths. (1129.)

(5724.) *Obs.* Spiral vessels have not been detected in several of these plants, such as *Caulinia*, &c. The leaves are also destitute of true cuticle.

(5725.) *ACORINÆ.*
GEN. RULE. Spathaceous or spadiceous (often both) monocotyledons, with the perianth scaly or absent, the germen superior, the fruit succulent or capsular, 1- seldom 3-celled, with albuminous seeds. (1114.)

(5726.) *Obs.* Albumen occasionally absent from the *Orontiaceæ;* and the *Lemnaceæ* are said to be destitute of spiral vessels.

(5727.) *LEMNACEÆ, De Cand.* and *Duby.* PISTIACEÆ, *Rich.*
GEN. RULE. Aquatic monocotyledons, with an abortive axis, leaves often confounded with the stem, spathaceous solitary achlamydeous flowers, fruit dry and superior, seeds albuminous, and the embryo with a lateral cleft. (1124.)

(5728.) *Obs.* Leaves confounded in *Lemna*, distinct in *Pistia.*

(5729.) *CALLACEÆ, Reichenbach.* PIPERITÆ (part), *Lin.* AROIDEÆ (part), *Juss.* ACORINÆ (part), *Link.* AROIDEÆ VERÆ, *Brown.*
GEN. RULE. Achlamydeous spadiceous monocotyledons, with separated flowers, the ovarium superior, formed of a single carpel, fruit fleshy, and the seeds albuminous; the leaves pedatinerved or subreticulate. (1121.)

(5730.) *Obs.* The embryo in *Caladium* has no distinct cotyledon, and germination takes place at several points.

(5731.) *ORONTIACEÆ, Brown.* ACOROIDEÆ, *Agardh.*
GEN. RULE. Spadiceous monocotyledons, with united flowers, having a scaly six-pieced perianth, superior germen formed of 3 connate carpels, albuminous seeds, and lineari-costate leaves. (1117.)

(5732.) EXCEPTIONS. Albumen sometimes absent, as in *Dracontium fetidum* and *polyphyllum.*

(5733.) *TYPHINÆ.*
GEN. RULE. Achlamydeous or glumaceous monocotyledons, with mostly separated flowers and spadiceous inflorescence, superior germen, carpels congested, seeds solitary and albuminous, and simple entire lineari-costate leaves. (1103.)

(5734.) EXCEPTIONS. The leaves are pinnate in *Phytelephas* or *Elephantusia.*

(5735.) *TYPHACEÆ, De Cand.* GRAMINIFOLIÆ NON CULMIFERÆ (part), *Ray.* CALAMARIÆ (part), *Lin.* TYPHÆ, *Juss.* TYPHINÆ, *Agardh.* CYPERACEÆ (part), *Link.* AROIDEÆ (part), *Brown.*
GEN. RULE. Spadiceous monocotyledons, with monœcious flowers, glumaceous perianth, 3-6 stamens, with long lax filaments and club-shaped anthers; the germen superior, and the seed solitary, pendulous and albuminous; the leaves unarmed. (1108.)

(5736.) *PANDANACEÆ.* Pandaneæ, *Brown.*
GEN. RULE. Spadiceous achlamydeous monocotyledons, with diœcious or polygamous flowers and superior germen; fruit drupaceous, dry and fibrous, 1-celled, and the seeds solitary, erect and albuminous; the leaves armed, and sometimes pinnate. (1104.)

(5737.) *Obs.* An obscure glumaceous perianth is found in the *Cyclanthidæ.*

(5738.) *PANDANIDÆ.*
GEN. RULE. Ib. Flowers achlamydeous and leaves simple. (1106.)

(5739.) *CYCLANTHIDÆ.*
GEN. RULE. Ib. Flowers with a degenerate glumaceous perianth, and the leaves divided. (1105.)

PALMALES OR PHOENICIALES.

(5740.) *SYN.* Arbores Arundinaceæ, *Ray.* Palmæ, *Lin.*, *Juss.*, &c.
GEN. RULE. Arborescent flowering endogenæ or monocotyledons, with rigid flabelliform or pinnati-sected leaves; a regular hexapetaloid perianth, superior germen, formed of 3 uniovulate carpels; the ovules median, the seeds albuminous, and the embryo aberrant, included and abhilose. (1081.)

PHŒNICINÆ.

(5741.) *ARECACEÆ.*
GEN. RULE. Ib. The spathes when present being complete.

(5742.) *PHŒNICACEÆ.*
GEN. RULE. Ib. The spathes being numerous and incomplete. (1088.)

GRAMINALES OR POALES.

(5743.) *SYN.* Culmiferæ, *Ray.* Gramina, *Lin.* Gramineæ, *Juss.*
GEN. RULE. Glumose endogenæ or monocotyledons, with round, nodose, hollow culms; split ligulate vaginæ; fruit a caryopsis, the seed albuminous, and the embryo lenticular and excluded, with a conspicuous plumule. (998.)

(5744.) Exceptions. A second cotyledon is sometimes developed, as in *Triticum.* It is however small, and not opposite the normal one.

(5745.) Note. For the differential characters of the subordinate divisions, see page 442, and § 1005, *et seq.*

CYPERALES.

(5746.) *SYN.* Graminifoliæ non Culmiferæ, *Ray.* Calamariæ, *Lin.* Cyperoideæ, *Juss.* Cyperaceæ, *Brown.*
GEN. RULE. Glumose or subglumose endogenæ or monocotyledons, with angular solid jointless stalks, and entire exligulate vaginæ. Fruit an akenium, seed solitary, and the embryo with an inconspicuous plumule, included within the albumen.

(5747.) Exception. Imperfect nodi are sometimes developed.

CARICINÆ.

(5748.) Caricaceæ.
GEN. RULE. Ib. The flowers being separated either monœcious or diœcious. (994.)

CYPERINÆ.

GEN. RULE. Ib. (5746.) The flowers being united. (987.)

(5749.) *SCIRPACEÆ.*
GEN. RULE. Ib. The glumelles pilose. (991.)

(5750.) *PAPYRACEÆ.*
GEN. RULE. Ib. The glumelles absent. (988.)

EQUISETALES.

(5751.) *SYN.* Capillaribus Aff., *Ray.* Coniferæ, *Lin.* Filices (part of), *Juss.* Equisetaceæ, *De Cand.* Gonyopterides, *Bart.* Stachyopterides, *Wild.*
GEN. RULE. Flowerless endogenæ or tubivascular acotyledons, with the fructification in terminal cones. The stems leafless, fistulose and articulate; and the vernation straight.

EQUISETINÆ.

(5752.) Equisetaceæ.
GEN. RULE. Ib. The order containing but a single genus.

PTERIDALES OR FILICALES.

(5753.) *SYN.* Capillares, *Ray.* Filices (part of), *Lin.* and *Juss.*

GEN. RULE. Flowerless endogenæ or tubivascular acotyledons, with foliaceous fruitbearing fronds. The thecæ dorsal or marginal, and the vernation gyrate.

(5754.) Exceptions. The vernation is not circinnate, but straight in the *Ophioglossidæ.*

POLYPODINÆ.

(5755.) GEN. RULE. Ib. The thecæ being annulate. (870.)

(5756.) *POLYPODIACEÆ.*

GEN. RULE. Frondose dorsiferous ferns, with annulate thecæ, indusia absent and conceptacles naked. (891.)

(5757.) *ASPIDIACEÆ.*

GEN. RULE. Frondose dorsiferous ferns, with annulate thecæ, indusia, and stalked conceptacles. (877.)

(5758.) *ASPIDIDÆ.*

GEN. RULE. Ib. Indusia single.

(5759.) *ONOCLEIDÆ.*

GEN. RULE. Ib. Indusia double, that is, placed on both sides of the sori.

(5760.) *GLEICHENIACEÆ.*

GEN. RULE. Frondose dorsiferous ferns, with annulate or zonate thecæ, and sessile or subsessile conceptacles. (872.)

(5761.) Note. For the characters of the subtypes *Gleichenidæ, Parkeridæ,* and *Hymenophyllidæ,* vide § 874, 875, and 876.

OSMUNDINÆ.

(5762.) GEN. RULE. Ib. (5753) The thecæ being exannulate.

Obs. The foliaceous part of the frond is often degenerate.

(5763.) *OSMUNDACEÆ.*

GEN. RULE. Frondose dorsiferous ferns, with exannulate thecæ, and 1-valved pellucid conceptacles. (865.)

(5764.) *OPHIOGLOSSACEÆ.*

GEN. RULE. Frondose dorsiferous ferns, with bivalved conceptacles, adnate, coriaceous, and opaque. (863.)

(5765.) *MARATTIDÆ.*

GEN. RULE. Ib. The vernation gyrate.

(5766.) *OPHIOGLOSSIDÆ.*

GEN. RULE. Ib. The vernation straight.

SELAGINALES.

(5767.) *SYN.* Musci (part of), *Ray, Lin.* Filices (part of), *Juss.*

GEN. RULE. Cryptogamic endogenæ, with solid inarticulate stems, for the most part foliose, but not dorsiferous.

(5768.) Exceptions. Tubular vessels have not been detected in the whole of these plants, but it is most probable that they exist.

(5769.) *LYCOPODINÆ.*

GEN. RULE. Ib. The conceptacles dehiscent and axillary, or indehiscent, through being included within the basis of the leaf-stalks. (839.)

(5770.) *LYCOPODIACEÆ, De Cand.* Lycopodineæ, *Swartz. Bartl.*

GEN. RULE. Cryptogamic endogenæ or tubivascular acotyledons, with solid, unstratified, leafy, inarticulate stems; the conceptacles free, axillary, and dehiscent. (843.)

(5771.) Exceptions. In *Bernhardia* or *Psilotum triquetrum* the foliage is abortive.

(5772.) *ISOETACEÆ.* Isoeteæ, *Bart.*

GEN. RULE. Cryptogamic endogenous acotyledons, with an abortive axis, solid cormus and indehiscent conceptacles inclosed within the bases of the leaves. (840.)

MARSILINÆ.

(5773.) *SYN.* Rhizocarpæ, *Batsch.* Rhizospermæ, *De Cand.* Hydropterides, *Wild.*

GEN. RULE. Ib. (5765.) The conceptacles free and indehiscent. (846.)

(5774.) *MARSILEACEÆ.*

GEN. RULE. Flowerless endogenous acotyledons, with distinct leaves and free indehiscent uniform conceptacles. (847.)

(5775.) *SALVINIACEÆ.*

GEN. RULE. Flowerless (endogenous?) acotyledons, with distinct, indehiscent conceptacles, of two kinds. (848.)

CHARALES.

(5776.) *SYN.* Capillaribus, Aff., *Ray.* Algæ (part of), *Lin.* Gonyopterides (part of), *Bartl.* Characeæ, *Rich.*

GEN. RULE. Cryptogamic, cellular, submerged aquatics, with a well developed axis and verticillate branches, destitute of leaves; and dimorphous, axillary, indehiscent, deciduous fruit, called nucules and globules.

CHARINÆ.

(5777.) *CHARACEÆ.*

GEN. RULE. Ib. The order containing but this single type. (788.)

(5778.) *Obs.* These plants have by some persons been considered phænogamic.

BRYALES.

(5779.) *SYN.* Musci (part of), *Ray.* (Musci Veri.) Musci Frondosi, *Lin.* Musci, *Juss.* Bryaceæ, *Bartl.*

GEN. RULE. Cryptogamic cellular plants, with a well-developed axis and leaves; and the urns furnished with opercula.

(57780.) *Obs.* The urns open transversely by the separation of the operculum or lid, but in *Andræa* the operculum adheres, and the urn dehisces by 4 valves, as in the *Hepaticales;* and in *Phascum* the urn is indehiscent.

PHASCINÆ.

(5781.) GEN. RULE. Ib. The operculum persistent, and the urn indehiscent.

(5782.) *PHASCACEÆ.*

GEN. RULE. Ib. The section containing but a single type. (769.)

BRYACINÆ.

(5783.) GEN. RULE. Ib. The operculum deciduous. (771.)

(5784.) *SPHAGNACEÆ.*

GEN. RULE. Ib. Ib. The peristome absent. (781.)

(5785.) *SPLACHNACEÆ.*

GEN. RULE. Ib. Ib. The peristome single. (780.)

(5786.) *BRYACEÆ.*

GEN. RULE. Ib. Ib. The persistome double. (773.)

ANDRÆASINÆ.

(5787.) GEN. RULE. Ib. (5779.) The operculum persistent, and the urn dehiscent lengthwise by valves. (768.)

(5788.) *ANDRÆACEÆ.*

GEN. RULE. Ib. Being the only type.

HEPATICALES OR MARCHANTIALES.

(5789.) *ALGÆ* Hepaticæ et Musci Hepatici, *Lin.* Hepaticæ, *Juss.*, &c. Musci Deoperculati, *Auct.*

GEN. RULE. Cryptogamic cellular plants, with foliose or foliaceous stems, the fruit consisting of deoperculate dehiscent urns. (745.)

(5790.) Exception. The urns are indehiscent in the *Ricciaceæ.*

HEPATICINÆ.

(5791.) GEN. RULE. Ib. Being the only section. (747.)

(5792.) *MARCHANTIACEÆ.*

GEN. RULE. Ib. The urns calyptrate and dehiscent. (753.)

(5793.) *TARGIONACEÆ.*

GEN. RULE. Ib. The urns veil-less and dehiscent. (752.)

(5794.) *RICCIACEÆ.*

GEN. RULE. Ib. Urns veil-less, imbedded in the frond, and indehiscent. (748.)

BOLETALES.

(5795.) *FUNGI* (part of), *Ray, Lin. Juss.* Fungi, *Greville.* Hymenomycetes, *Fries.*

GEN. RULE. Leafless, flowerless, cellular plants, furnished with an hymenium. (596.)

AGARICINÆ.

(5796.) GEN. RULE. *Boletales*, with the hymenium distinct, inferior, and ascigerous. (642.)

(5797.) *AGARICACEÆ.*

GEN. RULE. Ib. Hymenium lamellar or plicate. (682.)

(5798.) *BOLETACEÆ.*

GEN. RULE. Ib. Hymenium, sinuate, porous, or subulate. (648.)

(5799.) *AURICULARIACEÆ.*

GEN. RULE. Ib. Hymenium tuberculate, papillose or smooth. (644.)

HELVELLINÆ.

(5800.) GEN. RULE. *Boletales*, with the hymenium distinct, ascigerous, and superior. (639.)

(5801.) *HELVELLACEÆ.*

GEN. RULE. Ib. Hymenium not margined, receptacle cap-like and open. (634.)

(5802.) *PEZIZACEÆ.*

GEN. RULE. Hymenium margined receptacle, not cap-like. (628.)

(5803.) *CLAVARIACEÆ.*

GEN. RULE. Hymenium not margined, amphigenous, and the receptacle elongated. (617.)

TREMELLINÆ.

(5804.) GEN. RULE. Boletales, with the hymenium often not distinct, but blended with the receptacle; and asci absent. (612.)

(5805.) *CYPHELLACEÆ.*

GEN. RULE. Ib. Hymenium inferior, receptacle dry. (611.)

(5806.) *EXIDIACEÆ.*

GEN. RULE. Ib. Hymenium superior, receptacle irregular. (609.)

(5807.) *TREMELLACEÆ.*

GEN. RULE. Ib. Hymenium obscure, amphigenous. (608.)

TUBERALES.

(5808.) *FUNGI* (part of), *Ray*, *Lin.*, and *Juss.* GASTEROMYCETES and PYRENOMYCETES, *Fries.*

GEN. RULE. Leafless, flowerless, cellular plants, without hymenia, and enclosed in a pouch (peridium or perithecium.) (594.)

MUCEDINALES.

(5809.) FUNGI (part of), *Ray*, *Lin.*, *Juss.* CONIOMYCETES, *Fries.*

GEN. RULE. Leafless, flowerless, cellular plants, with naked sporidia, and furnished neither with hymenium nor peridium. (511.)

LICHENALES.

(5810.) *ALGÆ* (part of), *Ray*, *Lin.*, *Juss.* LICHENES, *Acharius*, &c.

GEN. RULE. Aerial, flowerless, cellular plants, with a distinct thallus, forming a foliaceous or pseudo-phyllous frond: and for the most part perennial. (338.)

FUCALES.

(5811.) *ALGÆ* (part of), *Lin.* and *Juss.* FUCI, *Greville*, *Phycei*, *Acharius.* THALASSIOPHYTA, *Lamouroux.*

GEN. RULE. Aquatic, flowerless, foliaceous, cellular plants, with the frond or thallus inarticulate. (230.)

CONFERVALES.

(5812.) *ALGÆ* (part of), *Lin.* and *Juss.* HYDROPHYTA, *Lyngbye.* ARTHRODIEÆ. *Bory St. Vincent.*

GEN. RULE. Flowerless, cellular plants, with articulate thalli: chiefly aquatic. (123.)

(5813.) NOTE. For the differential characters of the subordinate groups of this, and the four preceding orders, see page 306.

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FINIS.

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